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MAY 1953 — 25 CENTS

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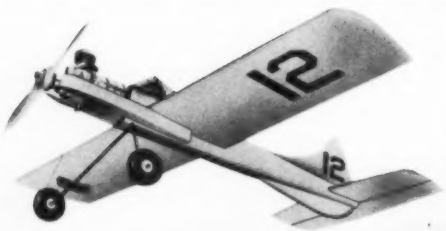

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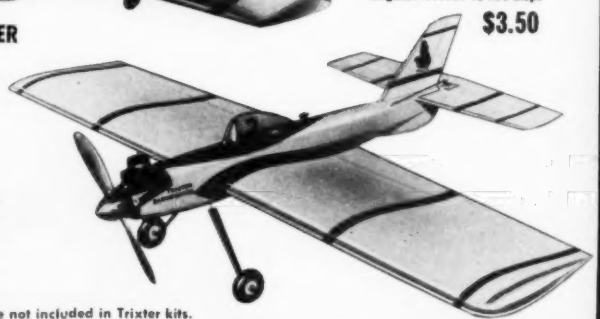

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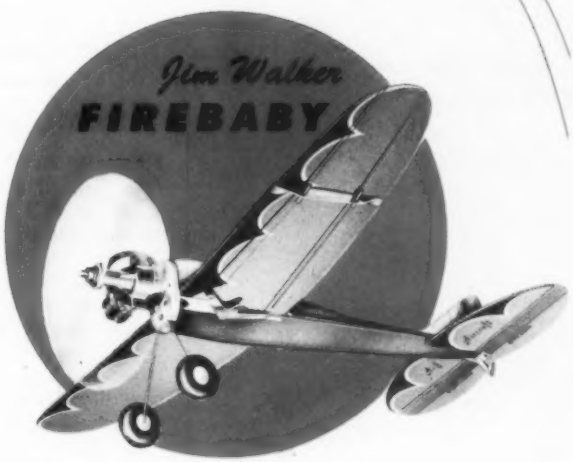

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MODEL AIRPLANE NEWS

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MAY 1953 Vol. XLVIII—No. 5

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WILLIAM WINTER, Editor
WITTICH HOLLOWAY, Art Director

Contributing Editors: Peter Chinn (England), Joseph Nieto, Harry Williamson

Executive and Editorial Office: 551 Fifth Avenue, New York 17, N. Y.

Advertising Manager, N. E. Slane, 551 5th Ave., New York 17; West Coast Adv. Mgr., Justin Hannon, 4068 Crenshaw Blvd., Los Angeles 43, Calif.

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by William Winter

▶ Ken "Sports Model" Willard, in again from California to discuss projected designs for M.A.N., described a Sunday morning session at Sepulveda Basin. Seventy-five cars lined up, each with its quota of models and modelers. Twenty-two rc jobs flown without interference or resort to threatened mayhem. By afternoon, the line of cars had doubled. That's the sort of activity that impresses town fathers who might think twice before giving the area over to golfers who obviously are in the minority. It's reassuring to know that Californy is still active; eastern visitors at the Nationals wondered what happened to the vaunted coast enthusiasm. But further north, up around Pop and Mom Robbers baliwick, San Francisco, the roster of WAM clubs has grown fantastically and the number of club members must be impressive.

Ken, and Keith Storey, who keeps on the ball for Duromatic and still finds time to mess with models and fulfill his duties as AMA prexy, get together on these MAN designs. Under development for many moons has been a cute bi-plane with gulled upper wing and the McCoy diesel for power. For some reason this reminds us of how long Ken has been in this airplane (big and little) business. First heard of him when he was with Parks Air College, long before the war. Modelers were amazed at that time by pictures in MAN of Willard's scale Waco, a perfectly huge crate that should take a .19 but which flew with the greatest of ease on an Atom. All these years, the man has been trying to prove the beneficial and realistic effects of getting rid of that surplus power. It seems to us that he has about proved the point.

Speaking of people, contributors in particular, the discriminating modeler who knows his who's who should be gratified with the collection of "names" who put this May MAN together. Just appointed contributing editor, Peter Chinn is a widely known model designer, author, columnist, and an authority on engines ranking second only to Ted Martin. Matter of fact, Pete conducts an "engine review" for a British monthly.

U-control fans will tell you that better team racers than Granger Williams' designs don't exist. The *F.A.S.T.* Club, to whom team racing is the breath of life, consider member Williams tops, an honor justified by his victory at the Nationals, flying scale all-metal Minnows. Team racing to Williams means scale. *Skeeter*, this issue, is the last word in Half-A scale, or team racers. It was one of the ships MAN at Work observed at a late night demonstration by the *F.A.S.T.* boys in a hangar at the last Nationals.

When it comes to scale free flight, Chuck Wood is a competent hand. His rubber contest jobs, like Yankee IV (January 1951 issue), are tops. Chuck held a national record in rubber. His designs have been widely built, including Japan and Australia. So if you have flying scale troubles, read his "Make it a Flying Scale" carefully, then forget about them.

Ray Matthews tops off his fine series on free

(Continued on page 5)

PLANE ON THE COVER — SOPWITH CAMEL

The Sopwith Camel, third in the series of Kotula paintings of historical aircraft, was one of the famous fighters of World War I. Though maneuverable, its rotary engine made it tricky to fly. The Camel makes a good free flight, or control line stunter, if sufficient weight is added to the nose. We invite our readers to send us the name of their all-time favorite. Future subjects will be picked in the order of their popularity.

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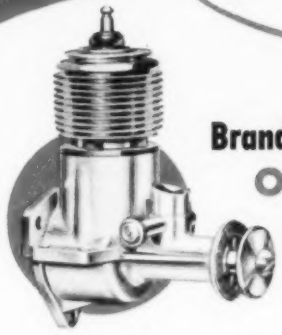

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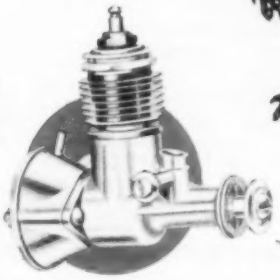

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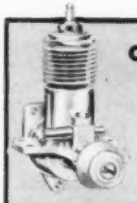

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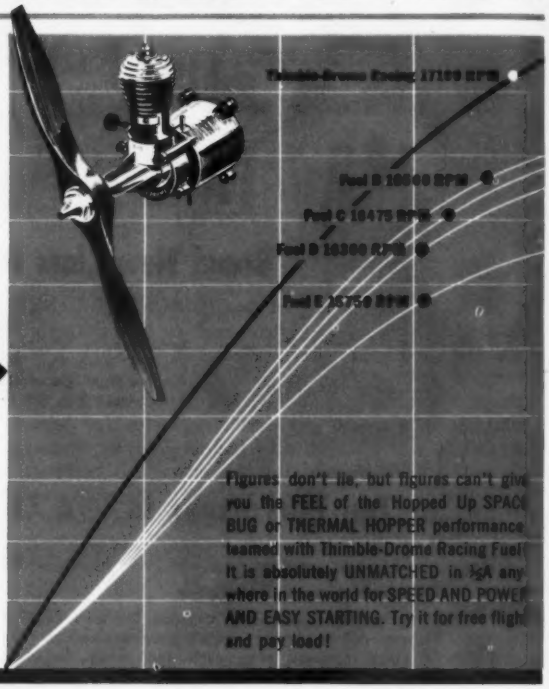
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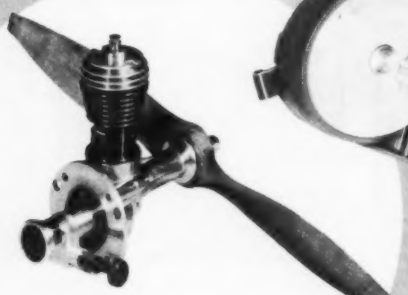

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Man at Work . . . . . .

(Continued from page 2)

flight this issue (much acclaiming mail from the experts on this): Ted Martin writes a report on the Cox *Space Bug*, that is a brilliant analysis of that engine's unusual features. This is "must" reading for anyone who thinks he knows engines.

* * *

Versatile Dick Ealy who comes up with some mighty popular boats, as well as natty aircraft, offers an air boat that many a vacationing modeler will take to the lake this summer. That new rules rubber job by Woody Blanchard is a corker, bettering 3-1/2 minutes with ease. That's tops in any league. But why shouldn't it be; Woody has contributed to the "hardware" shortage in the east for years.

* * *

First drawing we ever bought as an editor was from Paul Plecan about 15 years ago, a Seversky P-35. Since then Paul made a real name for himself as a draftsman in this field and others, including full-scale boat annuals. The drawing of the *Acrobat* rc, and the *Tiny Mite* all-balsa r.o.g. mark Paul's return to MAN. RC fans will never see a better combination plan than the *Acrobat* — with E. J. Brown's "CQ" on the reverse side, both being full size!

* * *

It's a rare flying session when you don't bump into an old timer. After building models for nearly 30 years, MAN at Work still doesn't qualify as an oldtimer. At a recent get-together, one chap showed up with a featherweight twin pusher. Arthur Heinrick, its builder, made his first crate in 1903, the year the Wrights put daylight between the ground and the skids of their frail bi-plane for the first time. Heinrick, where had we heard that name? In old Aircraft Yearbooks of the first world war vintage? Sure enough, this was one of the famous Heinrick brothers who designed and built their own models and airplanes and taught themselves to fly both in the early years of the century. Enthusiasts of historical airplanes know of the Orenco Scout, a really hot airplane that was too late for the fighting. Bob Hare reviewed it in his series in MAN. Looked like a super Spad.

* * *

Heinrick once held the full scale altitude record with passenger. In his plane producing days, the engineers and the shop used to vie with each other in special modeling contests. Tales of the great old timers, from a man who knew them. Early days of the Mulvihill. In the early twenties, contests still were judged by distances flown. One twin pusher did better than 3,000 feet. It was one of these historic models that Heinrick was flying. Roughly three feet in size it weighed a fraction over one ounce. This made it the lightest twin pusher of its day. Its designer had challenged anyone to better or duplicate its flying weight, but no one ever did. The booms were built up of two thin longerons with occasional cross pieces, the whole being tissue covered. The frame was thread braced. If one thread should break, said Heinrick, the frame would have collapsed. Aniline die was used to render a bird-like design to the wing; each of his ships was colored to resemble a bird after which it was named. What was particularly amazing about this fine flying featherweight was the fact that it won the Philadelphia sesqui-centennial model plane event in 1925!

* * *

It was a real thrill to talk with one of the great champs of bygone years and to examine and see fly one of the all-time masterpieces of model design and construction. Model building was a genuine craft in those days. The ships they flew were almost outdoor-indoor models, if you get what we mean. Darn few builders today who could match such a plane. The gas engine seems to have blunted the finer building skills.

* * *

Before the war, used to be fascinated by a white haired but well conditioned modeler. All of us used to throw assorted tools and stuff into a cardboard box or tool kit, then proceed to work on the ground, starting up engines in clouds of dust, loosing prop wrenches, getting dirt in the pump gun, and all the rest of it. But this guy had a small work stand, a collapsible affair with folding legs. In those rough and ready days of the "dust bowl" contests near Hicksville, this chap's precautions were judged sissy stuff. Never catch us with one of those things, said everyone who saw our boy comfortably at work. But how times change. At local rc sessions, practically everyone now sports one of these stands!

* * *

The thing is shaped like a deep box and has a carrying grip on top. Three legs swing down so that the top of the box stands almost waist high when the legs extend. The lid opens, exposing a shallow compartment handy for tools of the moment, like prop wrenches, screw drivers, and so on. Other drawers and compartments are below. Two U-shape pieces slide into position on each end of the box and you stand the model in the mounts, just like a boat on display. Start the engine there, too, if you fuel proof the box. As one modeler said, "the only time I bend over is to pick up the ship after it comes down."

* * *

The creator of this box turns out to be J. Broadfield Billings. There's another name the faintly rang a bell. Broadfield. To be sure, wasn't that the name of finished rubber jobs and gliders when we were in grammer school? Billings worked in the aircraft industry in World War I, then started his own model company which rivaled Ideal, which, for decades was the giant in the model aircraft field. Today his basement is full of wood working machinery. He turns out finished leading and trailing edges, and balsa hand-toss gliders. At the field the trunk of his car is a miniature traveling hobby shop for guys who break the last prop, need rubber or cement. When a contest comes, Billings has a kind of false front stand to dispense supplies and kits to excited spectators. Been doing this ever since MAN at Work has been going to contests. He tosses a neat free flight, too. Looks just as sharp as he did in 1938. Maybe that tool box is the secret.

* * *

Model Car kits must be booming. Always did admire the many oldtimers on display at the hobby shops. Revell sent a sample set of completed cars, each brightly colored and displayed in a clear plastic case on a black wood base. The 1903 Cadillac and Ford adorn the top of a nearby cabinet—the others dress up various book cases and mantels at home. Terrific, even if they don't fly. Ace just introduced a *Jaguar*—and to prove that one hand doesn't know what the other does—MAN had a Jaguar *plan* by Ealy in the February issue. Now comes along an announcement by F & B Model Airplane Kits for their *Jaguar*, Nash *Rambler*, and Chrysler *Imperial*, with stamped aluminum grilles and bumpers, rubber tires, plastic lights and steering wheels.

* * *

Something overlooked is the DeBolt (Dmeco) Senior *Live Wire* kit. Haven't seen so much stuff in a box since Bill Effinger, Berkeley, intoduced the big *Buc* and *Cavalier* kits. DeBolt hasn't pushed the big *Live Wire* in his ads but the ship deserves mention. Even if you don't fly rc steal a look at this kit.

* * *

Ever since Harold's successful entry into the rc flying as well as kit fields, rc activity around Buffalo has boomed. The Flying Bisons (Don Hobel, 70 Bigelow Rd., Buffalo, N. Y.) will run on May 18 an rc meet, followed by a free flight deal on June 28, for Half-A, A, B, and C combined; also rubber, towline and HL glider.

* * *

Talking of contests: Wakefield and FAI eliminations, May 23-24, at Wichita, Kansas (W. R. Weaver, 611 Lightner Dr., Wichita 17); Fifth Annual All Dixie Championships (M. M. Burley, 135 Oakwood Ave., Spartanburg, S. C.), July 12, for CL speed, stunt, jet, combat, scale; free flight, limited rubber, HL and TL Glider, RC.

* * *

New Clubs: The Lexington Aero Knights

(Continued on page 8)

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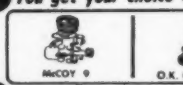
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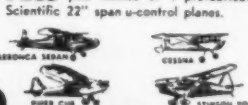
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Man at Work

(Continued from page 5)

(Verner Johnson, 1610 Ashwood Dr., Lexington, Ky.), sponsored by local Exchange Club, Bill White, pres.; Goldie Talbot, v.p.; Jim Singer, sec.-treas. Thirty-six members meet at Kings Hobby Shop, will hold official state meet, July 12.

Looking for new members, and offering class instruction to beginners, the Rock Island Model Airplane Club has 14 active members—and several others—meets alternate Thursdays at the local hobby shop. (Larry Dickinson, 1536-42nd St., Rock Island, Ill.). Club is member of Illinois-Iowa Aeronautical Assoc., who puts on annual Ukie, free flight, and indoor meets, with plaque to high point club. Rock Island took both ukie and ff plaque last year. Indoor, too. Beauty contest (non-flying) April 26; on June 14 the annual Air Derby, winner covering 25 miles in shortest time . . . Radio Modellers Association (L. Chioma, 6127 Alta Ave., Baltimore, Md.), held first meeting February 5. Meetings first Thursday, monthly, at Victory Villa Community House.

* * *

From the minutes of the February 13 meeting of the Western Associated Modelers: the 1953-54 stunt rules reputed to substitute three loops for five, two eights instead of three, two level laps between maneuvers, definite points of entry and recovery from maneuvers, inverted wingover maneuver, square-cornered eight, six minute run and point system of full credit each maneuver or two point loss each maneuver improperly done. And something the contestants can understand—WAM schools in stunt judging, speed timing, and pit management.

* * *

"What are the old ones doing?" the Louisville, Ky., Exhaust Gas wants to know. Sounds like typical club trouble. They have two groups: those that won't with some sort of feeble excuse and those that just won't. Even Bill Given, the guy who offers a prize to anyone who stumps him with a question, sounds desperate: "Haven't heard a peep from you, so we are presuming everyone in the Louisville area are experts."

* * *

Free Flight Tidbits: Capt. C. J. *Long Tom* Bryant, says his 150 sq. in. *Baby Toms* couldn't compete with 250-275 sq. in. coast Half A's. Large area and light construction is the coast trend. Sailplanes that weigh only 29-32 for B and C. What would they do in a 10-20 mile wind? Bryant thinks there should be a compromise. Has Atwood 49 *Long Tom* at 72", and a 56" A job, 20-1/2 oz., *Cub* 14 to *Torp* 19 . . . Says Claude McCullough of Matthews articles: "His tests of best model size for certain engines confirms my theory that the bigger the ship the higher the wing and power loading must be. I cling to the idea that the six-minute minimum of 20 seconds requires a 60 to 65 engine.

* * *

Do the new Wakefield rules apply in 1953? The answer is no. First flash received by MAN didn't state what year — now Wakefielders are in a tizzy. Relax boys and don't throw out those "old" designs until 1954. Hofmeister's One-One-One, last issue, is legit for this year.

* * *

See that James Monroe, Miami, who was high point winner at Tangerine Internats last year, took senior this time. Our own Woody Blanchard tied Bill Thomas, Jr. in Open. Flash from Jim Walker—who took off the top of a tree with his rc—has it that the west is going to beat the ears off the east in rc at the Nats and that this column is remiss if we don't warn you!

America's Hobby Center's 1953 spring catalogue (25c) consists of 128 pages with drawings and descriptions of 10,000 items, including lists of replacement parts for engines, and articles on building and flying. END

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Spitzy .045 Engine

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PLUS: All needed accessories as included in our other outfits. Everything but battery and fuel.

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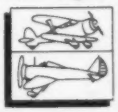

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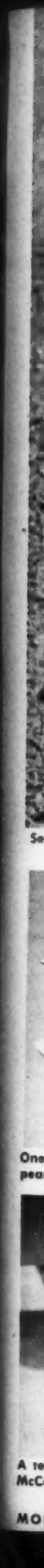


European Trends

Seen at a British contest, this Atwood 60 engined stunter proves that some fliers like the larger sizes. Odd feature is rubber held-on wing—but not a trend!

One of the most successful of European stunt designs is this sleek appearing Mercury-Monitor (a kit) from Britain for engines of .20 to .30.

A team racer by Phil Landry of the *Wimbledon Power Club*. Fitted with McCoy 29 engine, it laps at a steady 75 mph, has had several successes.

U-Control & Radio

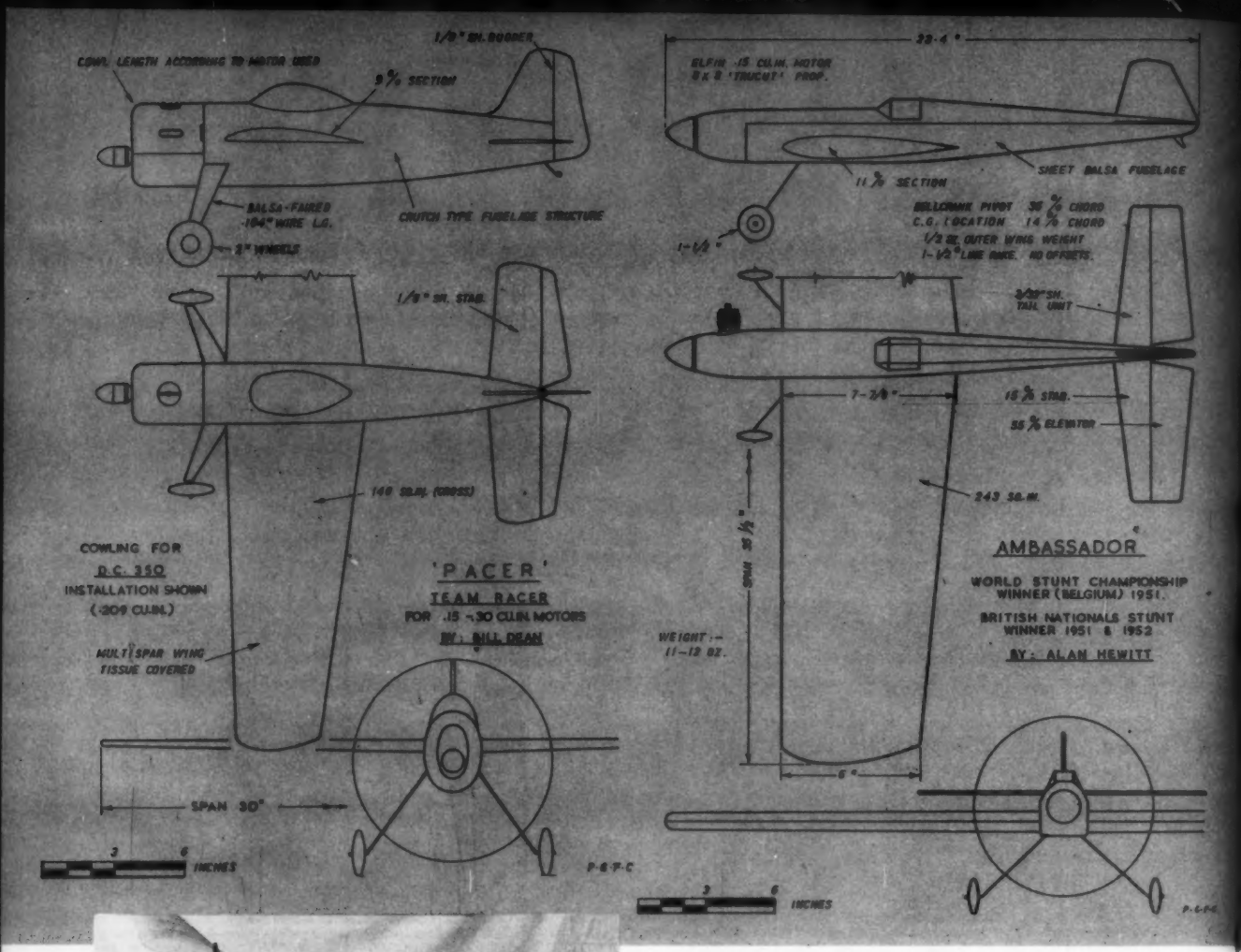
by PETER CHINN

An authoritative roundup of the latest winning planes in England and the continent, leading designs, methods.

In our first article on European trends, in which we dealt with free flight, we tried to drum up some interest in F.A.I. (International) competition and described the types of models now competing in these events and others in Europe.

In this second part, we are covering control line and radio control, and we particularly want to give an idea of the sort of opposition which awaits U. S. aspirants to official World Championship honors in control line. Let us say, right now, that it is in this field that international contest standards would benefit most greatly by American participation.

From small beginnings immediately after World War II, control line flying grew rapidly in Europe in the late forties. Italy and France were first off the mark, Britain lagging somewhat, just as she had done with pylon gas models, reluctant to accept what was variously alleged to be "a kid's game", "a circus turn"—in fact, anything but model aviation. When, in 1948, control line flying really did get under way in Britain, it was to stunt models that the majority turned, unlike the



Although rc design is about the same as U. S., more people go in for the huge and unique. This O & R 29 job by Sqn. Ldr. Eric Cable, from Malta.

U.S.A. where speed was U-control's first attraction.

Once accepted as a necessary part of the scene, control line snowballed to great popularity during the next two years in Britain and free flight development stood still by comparison. Meanwhile, on the Continent, steady expansion had been taking place, but without the British accent on stunt models.

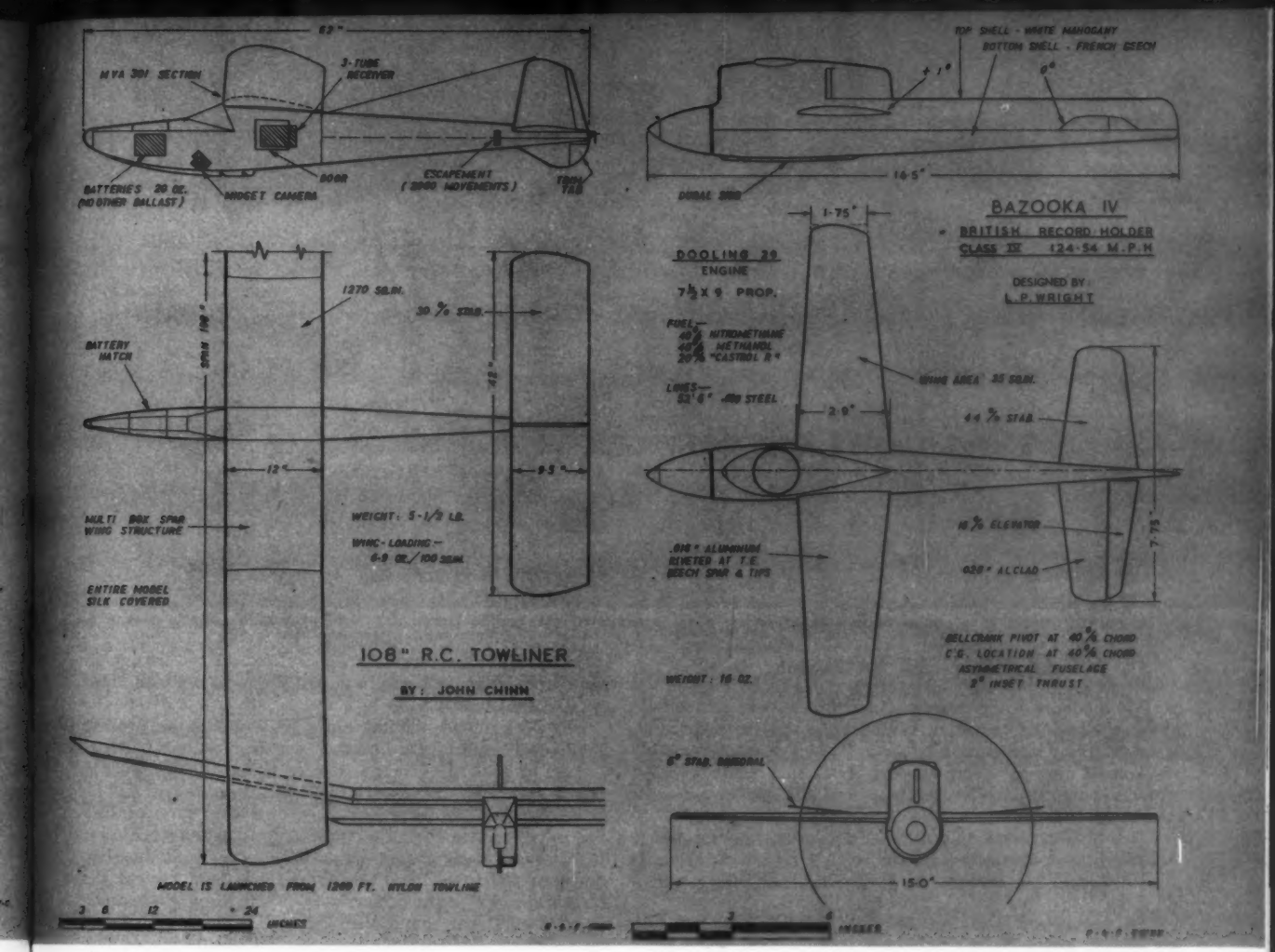
International contests over the past three years have clearly shown that the Continental European idea of stunt performance scarcely constitutes acceptable contest standards to Anglo-American eyes. Hence, the fact that British teams have scored successive wins in the last three European Areobatics Championships.

In speed events, countries are more evenly matched. Indeed, up to 1950, British performances fell far below those of France and Switzerland, but in the last F.A.I. World Speed Championships event, we had the pleasure of seeing four countries sharing top honors; Britain, France and Italy taking the 2.5 cc, 5 cc and 10 cc classes, respectively, and newcomers from Spain topping the jet class.

Had leading U. S. speed men been present and able to repeat their best performances, however, the story might have been very different. Top time in the 5 cc (AMA Class B) category, for example, was 123.2 mph by France's Dr. Millet (Dooling 29) which, satisfactory by European standards, looks less impressive beside the 130 mph performances achieved in the United States and is actually nearly 12 mph short of the F.A.I. figure set by Mark Brown using a K & B 19 at the last Plymouth sponsored International Trials. Likewise, Battistella's winning Italian job in the Class III (.61 cu. in.) category, returned 145 mph, a highly commendable performance which topped the then existing official world record held by France, yet has frequently been exceeded in the U. S. and is again bettered by Mark Brown's 154.6 mph at the aforementioned Plymouth Trials.

We would emphasize that these are not the highest recorded European performances in these two classes, but it is, nevertheless, to these two modelers that such distinction belongs, Dr. Millet having returned 131.5 in Class II at the 1952 Italian International meet in Milan, while Battistella put up 149 mph at the same time with his Dooling 61 in Class III. But such performances are the exception rather than the rule at the present time in Europe. The real specialists in speed are very few and for every outstanding performance, there may be a dozen others which are 20 mph slower. Lack of keen competition undoubtedly accounts, in part, for the fact that the best European speeds are always slightly below the U. S. For other reasons we can look to the engine department.

In both the 5 cc and 10 cc classes in Europe, the best speeds



are generally achieved with American-built motors—notably the Dooling 61, McCoy 60 Series 20 and Dooling 29. This is not at all surprising. The number of modelers actively interested in speed in the various European countries, is very small by comparison with the U. S. A. Model engine firms cannot afford the time for development work on racing engines, knowing that their labors will meet with scant financial reward. Others do not have the equipment for economic production of high quality racing engines.

It is therefore left to individuals to extract the necessary extra power from the standard racing type motors available by reworking them. Some good performances have been put up with European-built motors but, in general, no better than those possible with good examples of standard American types.

The most successful European-built racing engine in 10 cc class competition, has, so far, been the French Micron 60. First introduced in 1948, it subsequently achieved various wins and records, including an official F.A.I. Class III and Absolute World Record mark of 143.7 mph. It follows the standard disk-valve, ball-bearing layout.

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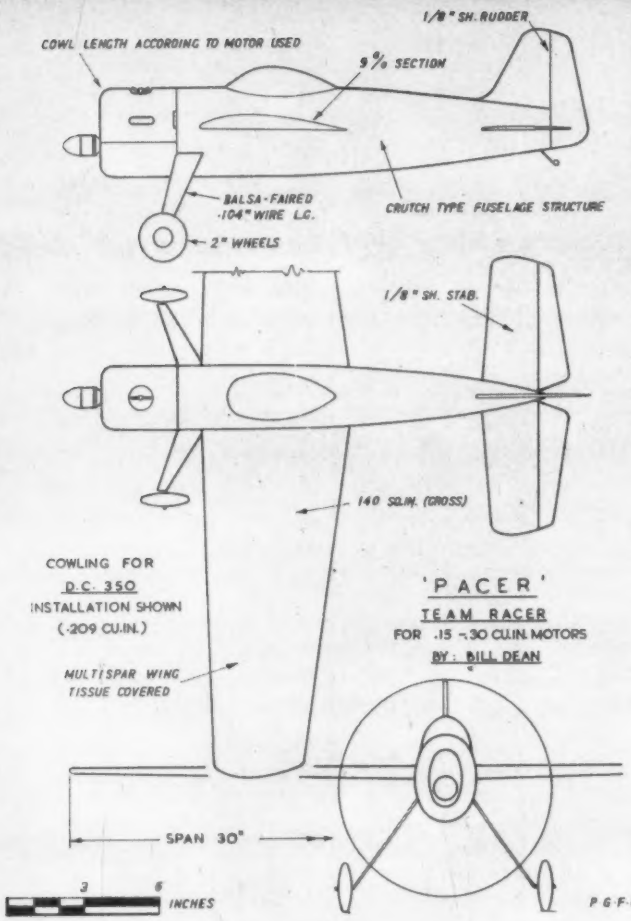
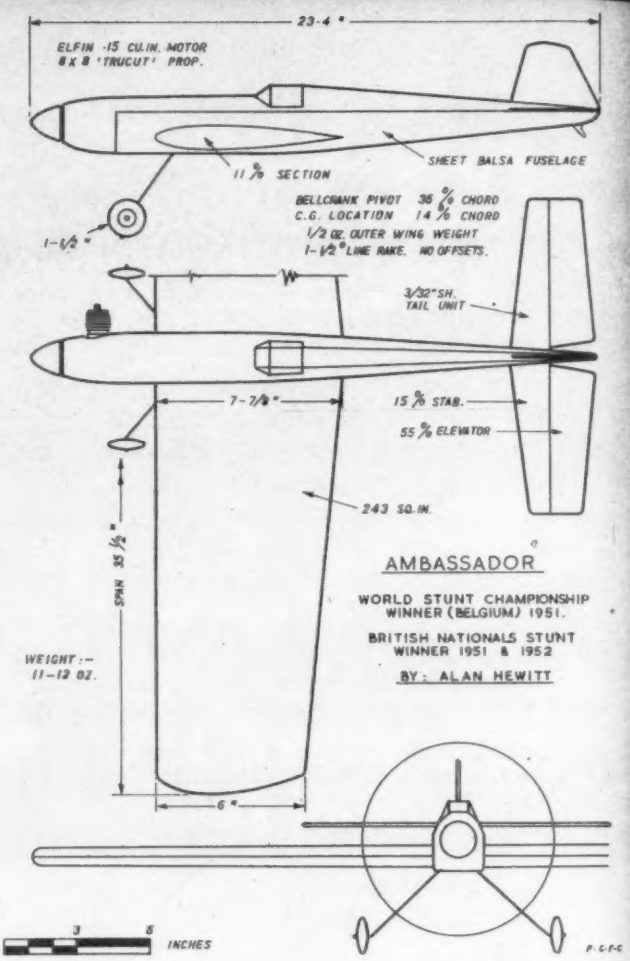
Billington of the British team that competed at World Championship Control Line meet at Knockke, Belgium, with Nordec and McCoy 60 speedsters.





Although rc design is about the same as U. S., more people go in for the huge and unique. This O & R 29 job by Sqn. Ldr. Eric Cable, from Malta.

U.S.A. where speed was U-control's first attraction.

Once accepted as a necessary part of the scene, control line snowballed to great popularity during the next two years in Britain and free flight development stood still by comparison. Meanwhile, on the Continent, steady expansion had been taking place, but without the British accent on stunt models.

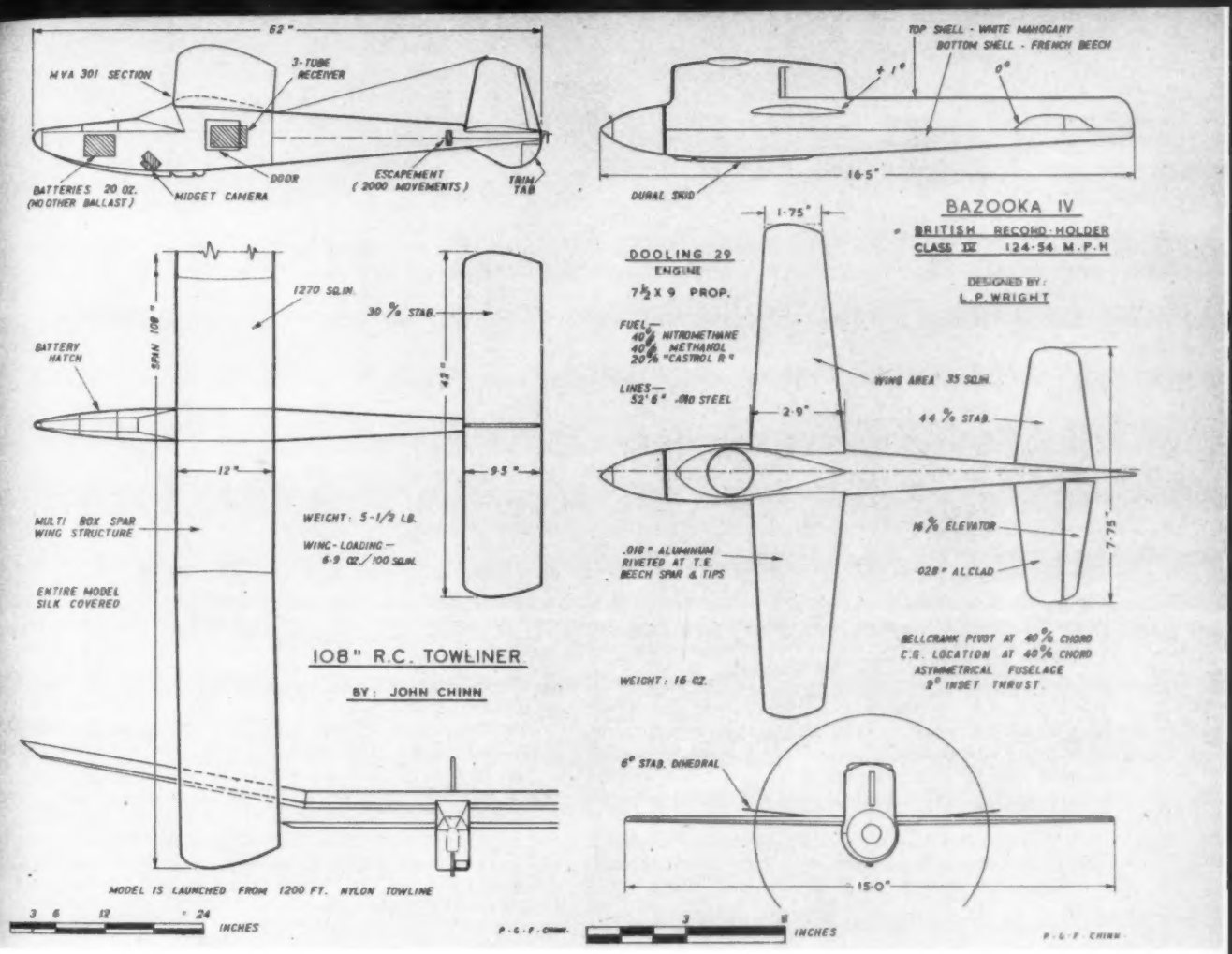
International contests over the past three years have clearly shown that the Continental European idea of stunt performance scarcely constitutes acceptable contest standards to Anglo-American eyes. Hence, the fact that British teams have scored successive wins in the last three European Areobatics Championships.

In speed events, countries are more evenly matched. Indeed, up to 1950, British performances fell far below those of France and Switzerland, but in the last F.A.I. World Speed Championships event, we had the pleasure of seeing four countries sharing top honors; Britain, France and Italy taking the 2.5 cc, 5 cc and 10 cc classes, respectively, and newcomers from Spain topping the jet class.

Had leading U. S. speed men been present and able to repeat their best performances, however, the story might have been very different. Top time in the 5 cc (AMA Class B) category, for example, was 123.2 mph by France's Dr. Millet (Dooling 29) which, satisfactory by European standards, looks less impressive beside the 130 mph performances achieved in the United States and is actually nearly 12 mph short of the F.A.I. figure set by Mark Brown using a K & B 19 at the last Plymouth sponsored International Trials. Likewise, Battistella's winning Italian job in the Class III (.61 cu. in.) category, returned 145 mph, a highly commendable performance which topped the then existing official world record held by France, yet has frequently been exceeded in the U. S. and is again bettered by Mark Brown's 154.6 mph at the aforementioned Plymouth Trials.

We would emphasize that these are not the highest recorded European performances in these two classes, but it is, nevertheless, to these two modelers that such distinction belongs, Dr. Millet having returned 131.5 in Class II at the 1952 Italian International meet in Milan, while Battistella put up 149 mph at the same time with his Dooling 61 in Class III. But such performances are the exception rather than the rule at the present time in Europe. The real specialists in speed are very few and for every outstanding performance, there may be a dozen others which are 20 mph slower. Lack of keen competition undoubtedly accounts, in part, for the fact that the best European speeds are always slightly below the U. S. For other reasons we can look to the engine department.

In both the 5 cc and 10 cc classes in Europe, the best speeds



are generally achieved with American-built motors—notably the Dooling 61, McCoy 60 Series 20 and Dooling 29. This is not at all surprising. The number of modelers actively interested in speed in the various European countries, is very small by comparison with the U. S. A. Model engine firms cannot afford the time for development work on racing engines, knowing that their labors will meet with scant financial reward. Others do not have the equipment for economic production of high quality racing engines.

It is therefore left to individuals to extract the necessary extra power from the standard racing type motors available by reworking them. Some good performances have been put up with European-built motors but, in general, no better than those possible with good examples of standard American types.

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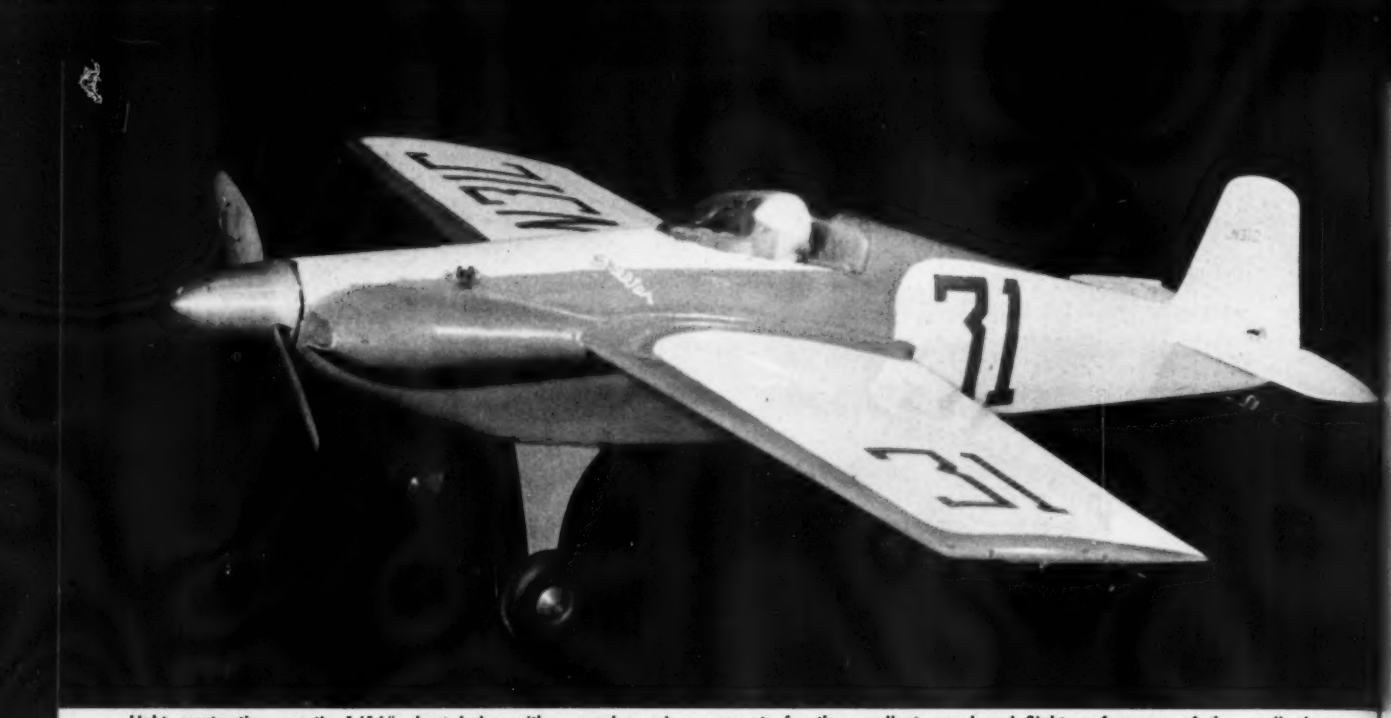
Billington of the British team that competed at World Championship Control Line meet at Knockke, Belgium, with Nordec and McCoy 60 speedsters.



Light construction, mostly 1/16" sheet balsa with a sparless wing, accounts for the excellent speed and flight performance of the small plane.

Skeeter

The nation's top ranking team racing pilot presents a Half A scale job that has real performance.

by GRANGER WILLIAMS

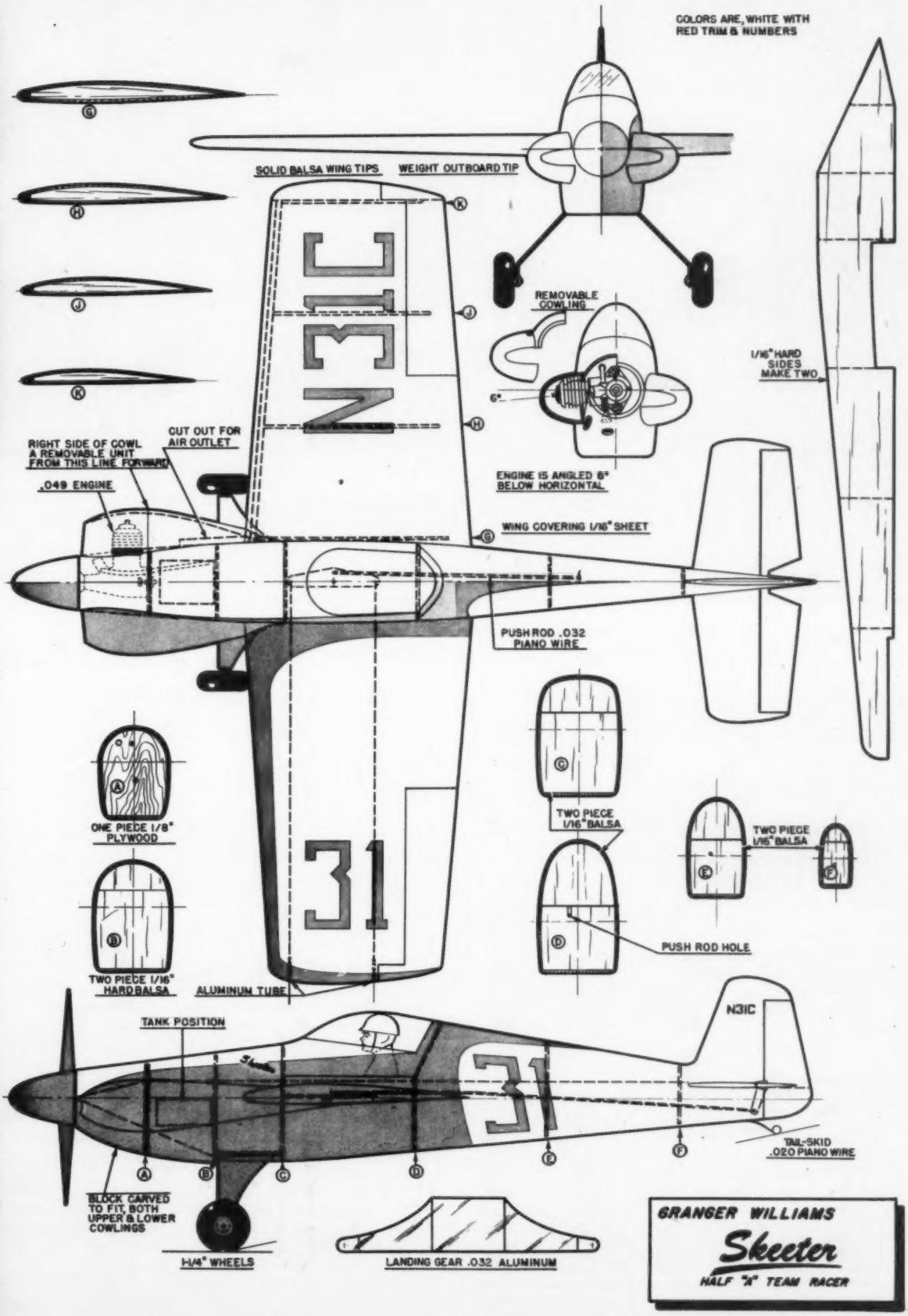
This model is of the cleanly designed little racer owned by Jimmie Kistler, a consistent contender at the air races and fairs featuring closed course racing. This airplane became a favorite of mine the first time I saw it, with its red and white color scheme, flashing around the pylons and streaking down the straightaway.

This .049 powered miniature of the prototype is a fast, stable flying model that is a natural for 1/2 A team racing and for public demonstrations of close formation flying with models.

To start construction, cut the sides and lower sections of bulkheads B to F from 1/16" medium hard balsa wood and assemble upside-down on the top view of the enlarged drawing. Cement together and, when dry, cement the bottom in place from bulkhead C aft, running the grain span-wise, from 1/16" balsa sheet.

The wing is made without spars; the 1/16" sheet covering is full span both top and bottom, with sections cut out fore and aft to allow the center section to fit into the notches cut into the two sides of the fuselage between bulkheads C and D. After thinning the trailing edges of the wing covering to a fine edge, cement the ribs onto the top covering behind a 1/8" square leading edge strip. When dry, sand the strip down to match the thickness of the ribs, and cement the bottom covering in place. Be sure to pin the wing upside-down on a flat surface so that there is dihedral in the lower surface only. When dry, trim the covering even with the leading edge strip and cement the *((Continued on page 52)*

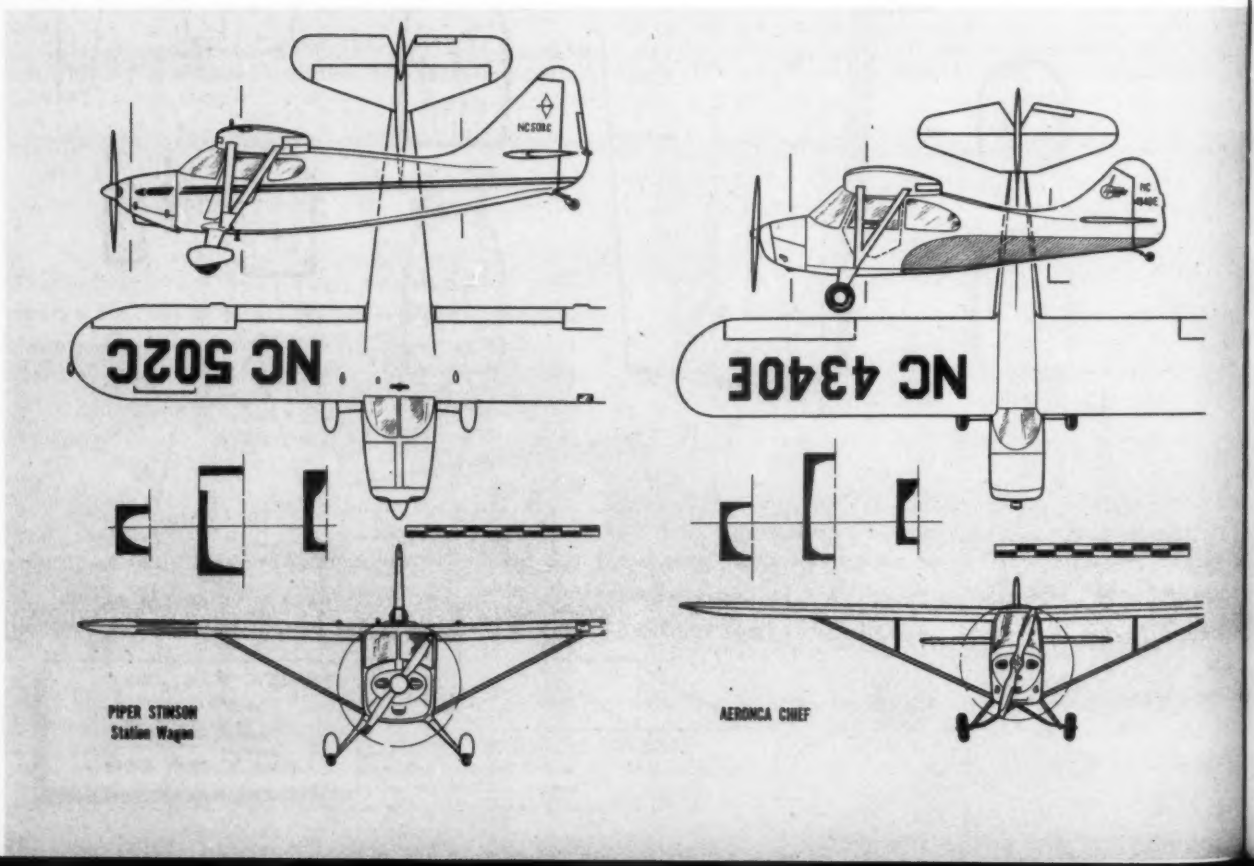
Above—At indoor exhibitions, the F.A.S.T. team flies three and four of these Half A's in closely stacked formations. Granger Williams, second from right. Right—Author shows relative size of his famous scale job.


COLORS ARE, WHITE WITH RED TRIM & NUMBERS
SOLID BALSA WING TIPS
WEIGHT OUTBOARD TIP
REMOVABLE COWLING
1/16" HARD SIDES MAKE TWO
RIGHT SIDE OF COWL A REMOVABLE UNIT FROM THIS LINE FORWARD
CUT OUT FOR AIR OUTLET
.049 ENGINE
ENGINE IS ANGLED 6° BELOW HORIZONTAL
WING COVERING 1/16" SHEET
PUSH ROD .032 PIANO WIRE
ONE PIECE 1/8" PLYWOOD
TWO PIECE 1/16" BALSA
TWO PIECE 1/16" HARD BALSA
ALUMINUM TUBE
PUSH ROD HOLE
TANK POSITION
N31C
TAIL-SKID .020 PIANO WIRE
BLOCK CARVED TO FIT BOTH UPPER & LOWER COWLINGS
1-1/4" WHEELS
LANDING GEAR .032 ALUMINUM
GRANGER WILLIAMS
Skeeter
HALF "A" TEAM RACER

FULL SIZE PLANS FOR BOTH "SKEETER" AND "INTERNATIONALIST" AVAILABLE. SEE PAGE 44.

Because hydro flying affords better protection to finish, details, author placed Royal Baby in 200 sq. in., 10-3/4 oz. Fairchild 24 on floats.

Why is it that duplication of the full scale ship so often has disastrous effects on the stability of the model?



In many cases the concentrated weight and power of a gas engine make a poor model. This *PT-11* weighs four ounces with rubber, and flies stably.

MAKE IT A FLYING SCALE

by CHUCK WOOD

One of the prettiest sights in modeling is a well built, correctly detailed flying scale ship, taking off for a near perfect flight. This is the goal of many builders, but unfortunately, the realization of only a few. Except in very rare instances exact duplication of the full scale ship is disastrous to stability in the model. Many builders have successfully constructed a flying scale model, but have had little success with the flying, either seriously damaging or washing out the model on the first flight. It is not hard to understand then why many builders do not attempt flying scale models, regarding them as just "too hot to handle."

There are two primary reasons why exact flying scale models make unstable flying ships. Inadequate stabilizer area is the first, and probably the most important cause of instability. Lack of stabilizer area results in short abrupt stalls under power and in the glide, and in poor recovery characteristics, even with the C. G. in correct position (25-33% of the wing chord from L. E.). This stabilizer area should be about 25% of the total wing area. Biplanes are somewhat an exception to this rule because of the loss in efficiency between the two wings, reducing the effective wing area to about 80% of the total wing area. In this case, base the 25% stabilizer area on 80% of the total wing area. Even when the stabilizer and wing areas are in correct proportion, instability and poor recovery characteristics may still result if the angular difference between the wing and stabilizer settings is less than three degrees.

An example of overpowering is author's Interstate *Cadet* with .045 engine, 145 sq. in wnig. Ship should not climb except on near full power.

The second reason exact scale models are unstable is lack of wing dihedral (at least 3/4" rise per foot of span is necessary). This lack of dihedral results in severe banks and a rocking motion from side to side called "dutch rolling." Under windy conditions the ship is upset laterally by every puff of wind and will probably spiral, dive or spin with little chance of recovery.

Even when C. G., stabilizer area, angular difference between stabilizer and wing, and wing dihedral are correct, many scale models are unstable because of overpowering. This has become particularly true since 1/2-A engines, with their greater thrust, have been introduced into flying scale models. Many builders simply do not realize the power of these sub-miniature engines.

An example of overpowering is my *Interstate Cadet* (N37208). This model has a wing area of 145 sq. in. and weighs 6-1/2 oz., powered by an .045 *Spitfire*. While this is about the right wing and power loading for contest duration, it is unsuitable for an inherently less stable scale model. This model did glide smoothly and fly well when the engine was running very rich. Under full power with the engine leaned out, it looped, rolled, spiraled and power dived. Using the .045 the model was left hanging (*Continued on page* 54)

For peak performance, author recommends maximum weight of 18 ounces for 2.5 cc, or .15 displacement, with a total area of 550 to 650 sq. in.

THE INTERNATIONALIST

Suitable for AMA or F.A.I. rules, this job was created especially for M.A.N. by a free flight expert familiar with F.A.I. designs.

by PETER CHINN

The timely appearance of Herkimer's new *Cub .14* motor of .149 cu. in., or 2.45 cc, fills a vacancy which has hitherto existed in the model engine market; the vacancy being an American-built motor complying with F.A.I. International free flight and Class I displacement category of 2.5 cubic centimeters maximum.

This gives us a good excuse to put in a plug for the International class free flight model. This model is becoming increasingly popular in Europe and is the only type free flight gas model recognized by the F.A.I. Model Commission, official world-governing body for model aircraft activities. Free-flight gas models entered for International contests and for the World Championship power event must conform with rules laid down by the F.A.I., to which all member countries, including, of course, the U.S.A., subscribe.

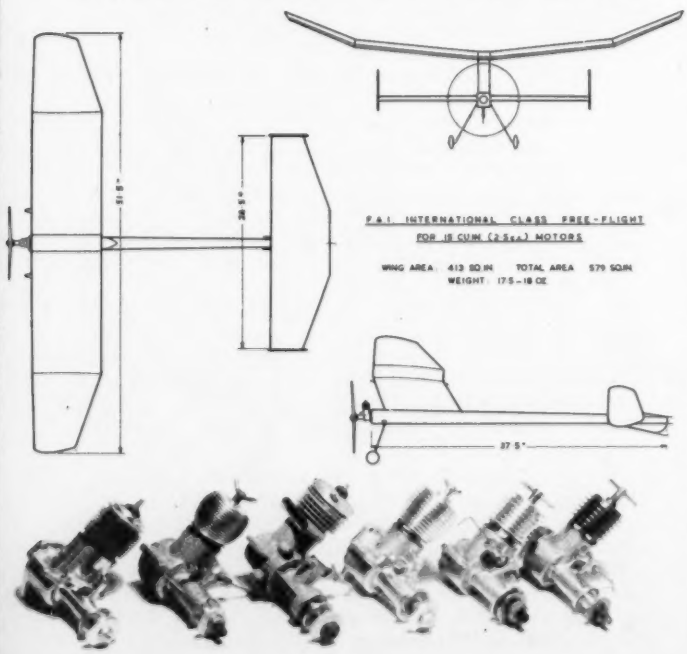
Rules require that the ship shall have a power loading of 200 grammes (7.06 oz.) per cubic centimeter of engine displacement; that is to say, about 116 oz./cu. in., or slightly heavier than the A.M.A. 100 oz. rule. The biggest displacement motor allowed is 2.5 cc (.1525 cu. in.). This means that, if you use a motor of full 2.5 cc displacement, your model with engine must weigh 17.65 oz., or 2.4 oz. more than if you were working to A.M.A. rules.

Design cleverly combines features familiar to American free flighters, so this is one F.A.I. job that will not seem strange to build and fly.

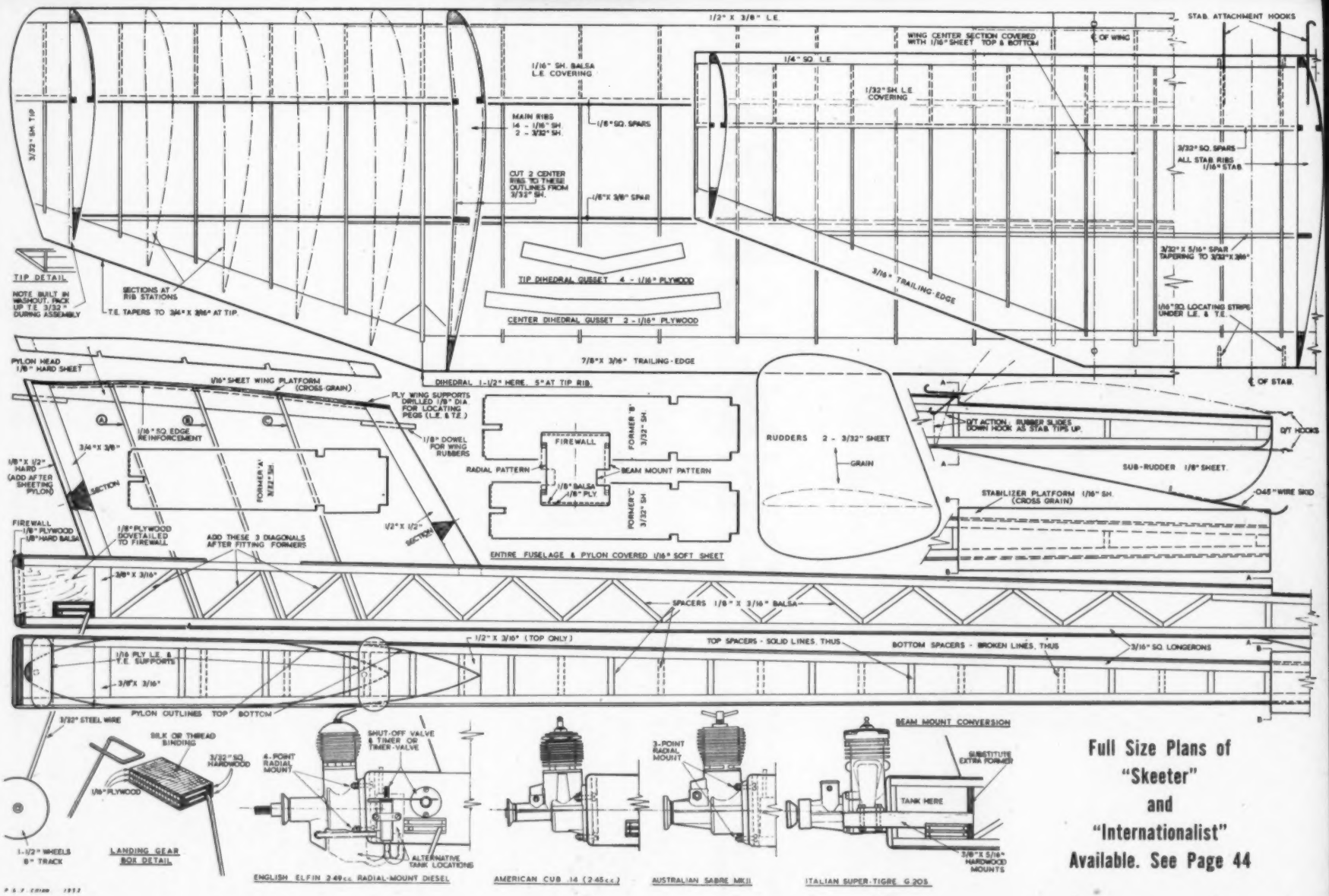
There is also a wing-loading rule of 12 grammes per square decimeter, or 3.93 oz./sq. ft., of all horizontal surfaces (i.e. wing *and stabilizer*) but this is so moderate as to mean that wing loading will be no greater than the majority of Class A models built under the A.M.A. formula which imposes no minimum wing loading. The sole remaining requirement is a moderate cross-section rule in which fuselage cross-sectional area must equal, or exceed, 1/80 of total wing and stab area.

So, you see, there are no very great differences between A.M.A. and F.A.I. rules and a model built to this International formula will also be eligible for A.M.A. recognized contests.

There remains the question of deciding on a layout best suited to Americans, as well as International, requirements. It will have been noted that, unlike other World Championship events such as Wakefield (rubber) and Swedish Cup (glider), International power does not, at the present time, fix a definite size and area. A smaller model than 2.5 cc can, in fact, be used and weights and areas adjusted accordingly. An American .099 (Arden, McCoy or Cub .099, etc.) could, therefore, be employed in a model (*Continued on page* 36)



Left—Typical 15's that can be used: the American Cub, English *Elfin*, Italian *Supertigre*, Australian Sabre, Dutch *Typhoon*, and German *Webra*.


1/2" X 3/8" L.E.
STAB. ATTACHMENT HOOKS
WING CENTER SECTION COVERED WITH 1/16" SHEET TOP & BOTTOM
℄ OF WING
1/4" SQ. L.E.
1/16" SH. BALSA L.E. COVERING
1/32" SH. L.E. COVERING
MAIN RIBS 14 - 1/16" SH. 2 - 3/32" SH.
1/8" SQ. SPARS
CUT 2 CENTER RIBS TO THESE OUTLINES FROM 3/32" SH.
1/8" X 3/8" SPAR
3/32" SQ. SPARS
ALL STAB RIBS 1/16" STAB.
3/32" SH. TIP
3/32" X 5/16" SPAR TAPERING TO 3/32" X 3/16"
TIP DETAIL
NOTE BUILT IN WASHOUT. FACE UP T.E. 3/32" DURING ASSEMBLY
SECTIONS AT RIB STATIONS
T.E. TAPERS TO 3/4" X 3/16" AT TIP
TIP DIHEDRAL GUSSET 4 - 1/16" PLYWOOD
3/16" TRAILING EDGE
CENTER DIHEDRAL GUSSET 2 - 1/16" PLYWOOD
1/16" SQ. LOCATING STRIPS UNDER L.E. & T.E.
PYLON HEAD 1/8" HARD SHEET
1/16" SHEET WING PLATFORM (CROSS GRAIN)
7/8" X 3/16" TRAILING-EDGE
DIHEDRAL 1-1/2" HERE, 5" AT TIP RIB
℄ OF STAB.
PLY WING SUPPORTS DRILLED 1/8" DIA FOR LOCATING PEGS (L.E. & T.E.)
1/16" SQ. EDGE REINFORCEMENT
1/8" DOWEL FOR WING RUBBERS
FORMER "B" 3/32" SH.
FIREWALL
RADIAL PATTERN
BEAM MOUNT PATTERN
1/8" BALSA 1/8" PLY
FORMER "C" 3/32" SH.
RUDDERS 2 - 3/32" SHEET
GRAIN
D/T ACTION. RUBBER SLIDES DOWN HOOK AS STAB TIPS UP.
D/T HOOKS
SUB-RUDDER 1/8" SHEET.
3/16" X 3/8"
1/8" X 1/2" HARD (ADD AFTER SHEETING PYLON)
SECTION
FORMER "A" 1/8" PLY
STABILIZER PLATFORM 1/16" SH. (CROSS GRAIN)
.045" WIRE SKID
FIREWALL 1/8" PLYWOOD 1/8" HARD BALSA
1/8" PLYWOOD DOVETAILED TO FIREWALL
ADD THESE 3 DIAGONALS AFTER FITTING FORMERS
1/2" X 1/2"
ENTIRE FUSELAGE & PYLON COVERED 1/16" SOFT SHEET
3/8" X 3/16"
SPACERS 1/8" X 3/16" BALSA
1/2" X 3/16" (TOP ONLY)
TOP SPACERS - SOLID LINES, THUS
BOTTOM SPACERS - BROKEN LINES, THUS
3/16" SQ. LONGERONS
1/16 PLY L.E. & T.E. SUPPORTS
3/8" X 3/16"
PYLON OUTLINES TOP BOTTOM
3/32" STEEL WIRE
SILK OR THREAD BINDING
3/32" SQ. HARDWOOD
1/16" PLYWOOD
1-1/2" WHEELS 8" TRACK
LANDING GEAR BOX DETAIL
4-POINT RADIAL MOUNT
SHUT-OFF VALVE & TIMER OR TIMER-VALVE
ALTERNATIVE TANK LOCATIONS
ENGLISH ELFIN 2.49cc RADIAL-MOUNT DIESEL
AMERICAN CUB 14 (2.45cc.)
3-POINT RADIAL MOUNT
AUSTRALIAN SABRE MKII
BEAM MOUNT CONVERSION
SUBSTITUTE EXTRA FORMER
TANK HERE
3/8" X 5/16" HARDWOOD MOUNTS
ITALIAN SUPER-TIGRE G.20S

Full Size Plans of "Skeeter" and "Internationalist" Available. See Page 44

Fred Salman, of Lubbock, Texas, launches a Class A original ship at the 1951 Dallas Nationals.

There's no double talk in this analysis of free flight gas model adjustments, the windup of a series of articles that separate facts from fiction.

▶ SECRETS...

by RAY MATTHEWS

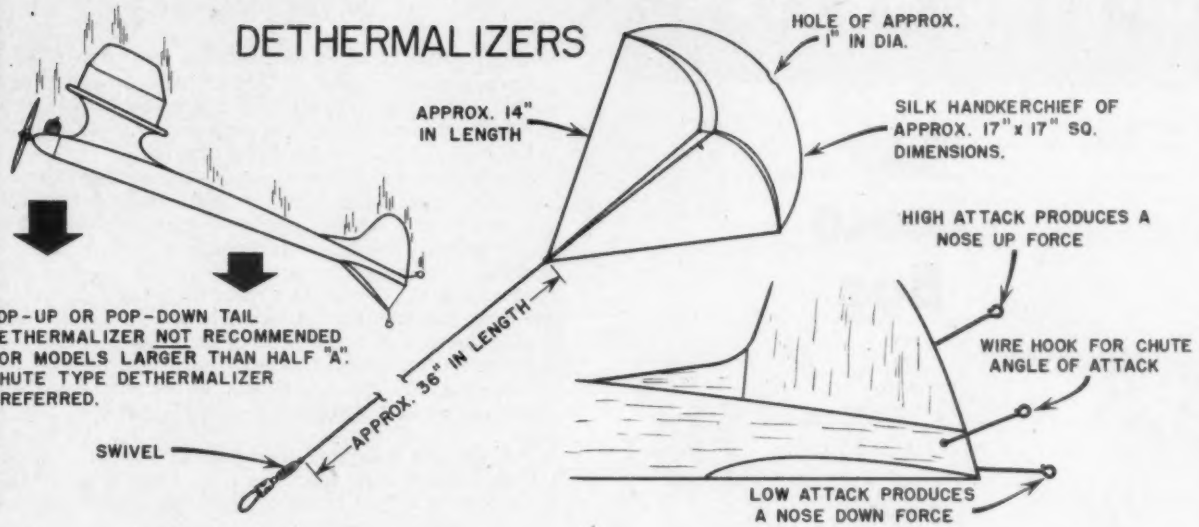
▶ When I finish a ship late at night, which is usually the case, I start off by sleeping late the next morning and going fishing or to a picture show or just anything to keep from flying it until I am mentally rested and have had a chance to recheck all alignments with a clear head. When I do get around to flying, it's done at the calmest time I can find, which is usually early morning, or late evening. Test flying starts with a series of test glides until I am satisfied with the results. Here is what I try for in the glide: first, I keep adding incidence until I have a slightly noticeable mush and then add a little left turn with the rudder or by tilting the stab. I like to use a combination of both of these to obtain a glide turn. If all glide turn is obtained with the rudder, it may require more offset thrust to counteract the rudder, and if all turn is had by a tilted stab, there will be no rudder to offset the gyroscopic action. As far as the glide turn is concerned, I would like to use only the tilted stab as the turn is flat, and the danger of spiral dives in glides is minimized. Sure, the flat turn is not a perfect turn aerodynamically but, contrary to common belief, it results in a slower sinking speed. You may question the slight mush that I spoke of, so here is why. This "mush" was with model gliding straight so, when turn is put in, mush disappears. Did you ever stop to think that the angle of attack decreases in a turn, so a model that has a flat glide going straight might spiral drive in glide if turn is added without adding incidence?

The hand glide is not conclusive in itself because you can't release the model at its exact gliding speed. Just for example, I can take one of my ships, take out all incidence and turn, and with a very hard throw make it glide from my hand. I can also put in too much incidence and glide the model too slow, and it will still glide. It's my belief that many modelers can't "feel" the model, and there isn't any way I can explain just how it should be done. The system I use is to run into the wind with model in a flying attitude and nose down slightly until I can feel it lift, then give it a push. This procedure is repeated time and time again until the "push" feels and looks right. Beware of "ballooning" your model when hand gliding it; this seems to be the number one trouble with most of us. So when my arm is tired of "toting" this "box" I check mechanical gadgets for operation "just in case". The first power flight is made at very low power. Low power can be had by pluging the opening in your intake down to a very small air inlet.

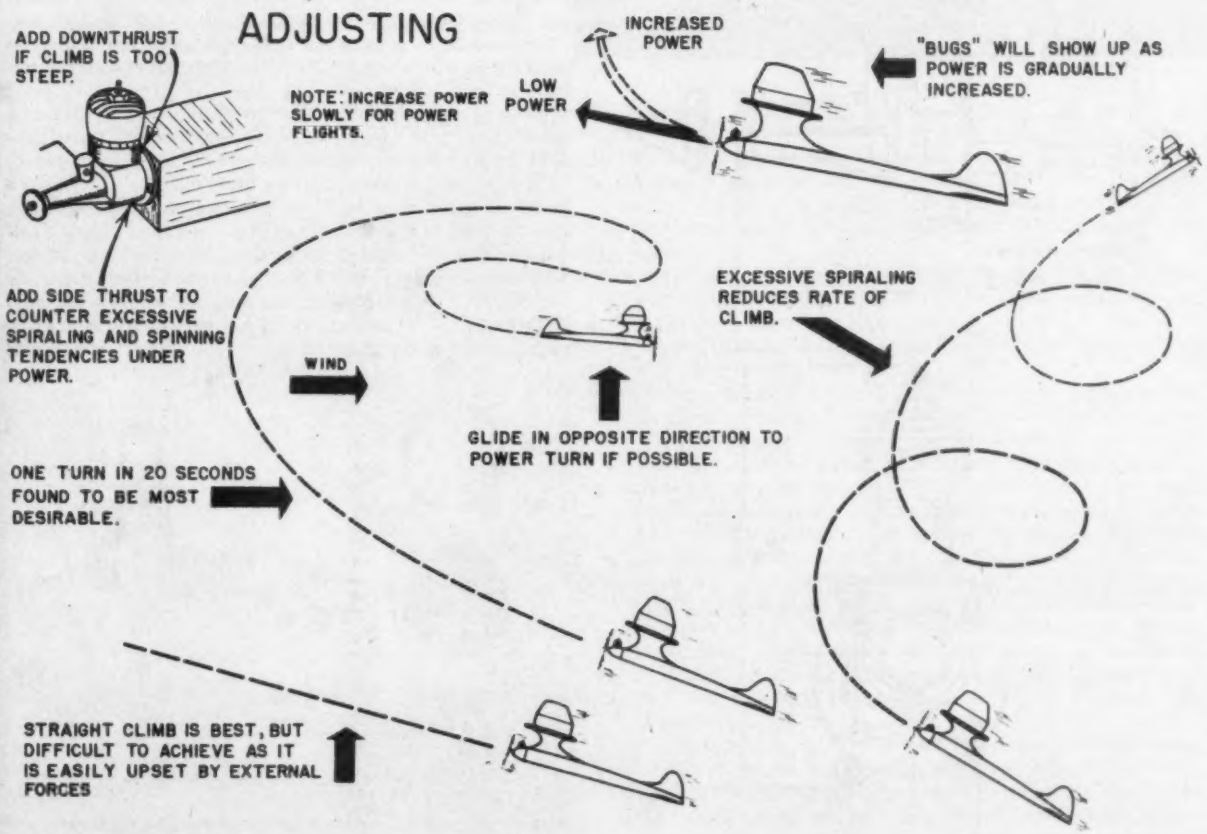
At this point in the game, all I am trying to do is get model up high enough to watch the glide and, of course, correct for any real trouble in thrust. Work glide out first because almost anything you do to change the glide will affect the power flight, but once glide is Okay don't touch it—do the rest with thrust adjustments. Now don't forget that if glide turn is too wide don't close the turn up unless you add just a little incidence for insurance. When I am happy with the glide, I start increasing power just a little with each flight and watch results carefully. Under low power there isn't too much you can see, but when too steep a climb or a tight spiral starts to show its ugly head with more power, I start correcting with thrust. How much thrust does it take? It takes enough to stop the undesirable characteristics no matter whether it's one degree or ten degrees. If it becomes apparent that it is going to require a great deal of offset thrust to side or down, I go back and check angular difference between wing and tail and recheck the CG position.

What I am trying to get in the climb is about one turn in 20 seconds at full power and somewhere between 800 feet and 1,000 feet in this time. I also like the model to go out almost straight for about 100 feet before making upward turn because, in this time, it can accelerate up to maximum speed. Properly adjusted for maximum climb, you can't help having this condition because downthrust force exceeds nose-up tendency until best climb speed is obtained, then up it goes. I wish there were some way I could check the speed of my ships in level flight at full power, but I can't. I can only guess that they reach 80 to 100 mph. I base this on an experiment with an Ohlsson 60 powered

(*Continued on page* 51)


DETHERMALIZERS
HOLE OF APPROX. 1" IN DIA.
APPROX. 14" IN LENGTH
SILK HANDKERCHIEF OF APPROX. 17" x 17" SQ. DIMENSIONS.
HIGH ATTACK PRODUCES A NOSE UP FORCE
POP-UP OR POP-DOWN TAIL DETHERMALIZER NOT RECOMMENDED FOR MODELS LARGER THAN HALF "A". CHUTE TYPE DETHERMALIZER PREFERRED.
APPROX. 36" IN LENGTH
WIRE HOOK FOR CHUTE ANGLE OF ATTACK
SWIVEL
LOW ATTACK PRODUCES A NOSE DOWN FORCE

...of free flight....part three


ADJUSTING
ADD DOWNTHRUST IF CLIMB IS TOO STEEP.
NOTE: INCREASE POWER SLOWLY FOR POWER FLIGHTS.
INCREASED POWER
LOW POWER
"BUGS" WILL SHOW UP AS POWER IS GRADUALLY INCREASED.
ADD SIDE THRUST TO COUNTER EXCESSIVE SPIRALING AND SPINNING TENDENCIES UNDER POWER.
EXCESSIVE SPIRALING REDUCES RATE OF CLIMB.
WIND
GLIDE IN OPPOSITE DIRECTION TO POWER TURN IF POSSIBLE.
ONE TURN IN 20 SECONDS FOUND TO BE MOST DESIRABLE.
STRAIGHT CLIMB IS BEST, BUT DIFFICULT TO ACHIEVE AS IT IS EASILY UPSET BY EXTERNAL FORCES

Engine Review

Cox Space Bug

by TED MARTIN

▸ The Thimbledrome *Space Bug* .049 incorporates major technical advances in Half A. The efficiency of these fundamental changes are proved by the resulting performance. Craftsmanship and general provision for long life and sustained peak output are of the very highest order.

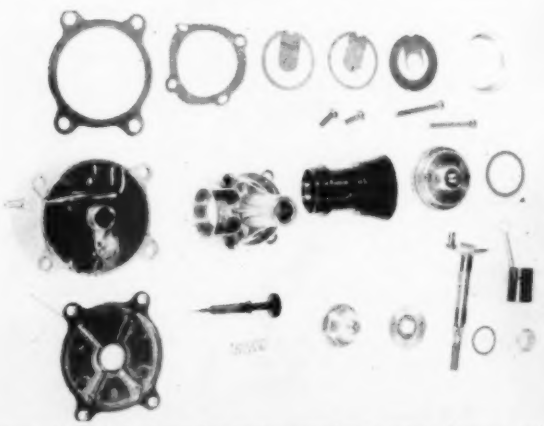
To achieve the performance figures attested to by our own bench tests of the *Space Bug*—see table at end of article, Cox was well aware when designing this engine of possible, first unfavorable impressions of the tank size and position, the position of the intake for choking, combined head and plug, the need of tank replacement in event of jet damage, the long overhang, but felt that the means justified the end. These features are part of the design picture of the engine and so help attain the high rpm figures in the tables.

The reasons for these unorthodox features will become evident when the working of the *Space Bug* is thoroughly understood.

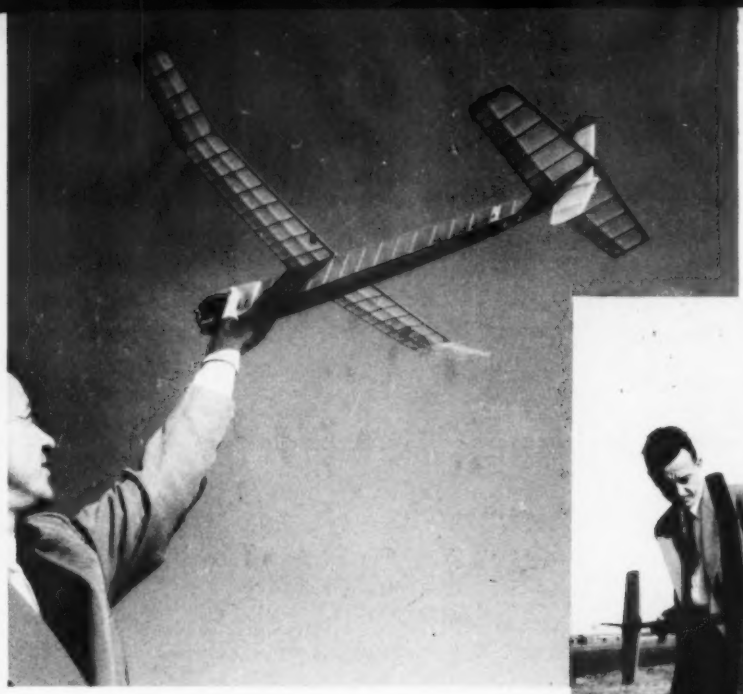
For the first time appearing on a production engine is the glo element built directly into the cylinder head. This results in a near perfect hemispherical combustion chamber with no crevices and obstructions to impede gas flow to the filament and obstruct the radially expanding flame front. It also definitely controls compresion ratio by precluding the use of different plugs with element recesses of indeterminate volume. This has a very great effect upon small engines and it is important in all Half A motors to stick to plugs specified by the manufacturer. The *Space Bug* head has a very small element recess, thereby minimizing unscavenged dead space round the filament which dilutes the fresh charge of mixture with trapped burnt gases in the place where you least want it. Finally, this head, being made entirely from aluminum, presents a combustion chamber surface of uniform temperature and texture. This head design is an important factor in achieving the outstanding performance of this engine, and on test, under four hours of hammering at high speed, and using two volts for starting, along with other deliberate abuse, the element refused to burn out.

Even in the apparently rare event of a new head being required, the cost of only sixty-five cents compares favorably with that of a conventional plug, in view of the extra efficiency.

The cylinder is executed from heat treated alloy steel, the bore having a surface finish and accuracy that are exceptional, and the general cylinder design has a welcome rigidity that will preserve this accuracy under the most arduous conditions. The integral cooling fin and porting arrangement is renowned for efficiency with freedom from bore distortion, a common weakness, and is a system which has been amply proven by highly stressed European diesels. (*Continued on page* 46)



Below—Parts of the Space Bug engine reveal more unique features, such as combination plug-head, needle in tank, and the reed-valve intake.



The new "limited 200" rules call for 200 sq. in. total area. This 1953 design does an honest 3½-4 minutes.

Points to note include the pop-up stabilizer arrangement, close fit of folded blade to the fuselage side.

Below—A 34-inch long motor is used, consisting of 12 strands of 1/4 flat. Climb is steep nose-up, 45 deg.

AMAzer

Below—Woody shows off attractive plan form of the tapered wing. Construction features sliced ribs, over and under the tapered spars.

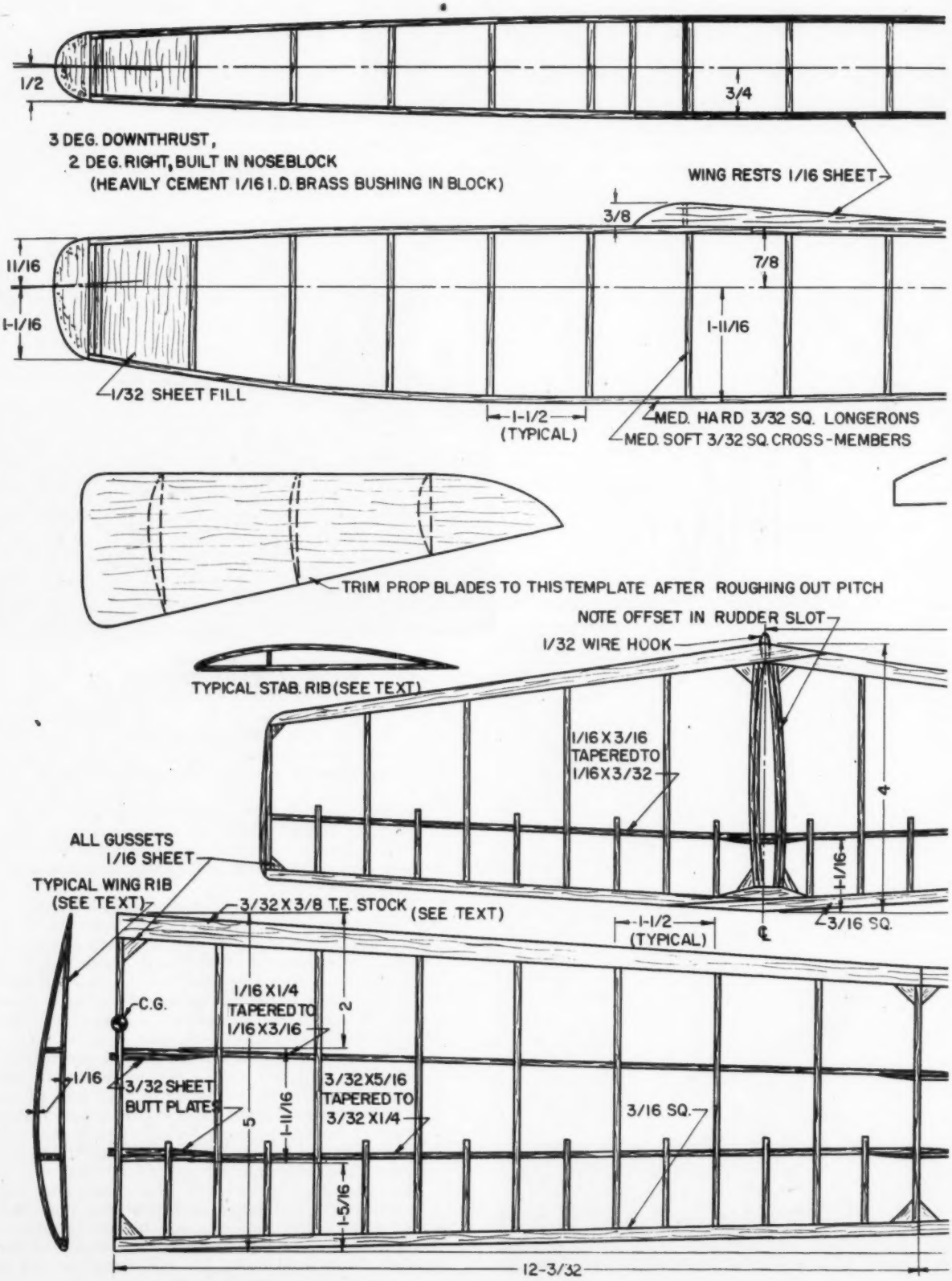
By W. S. BLANCHARD, JR.

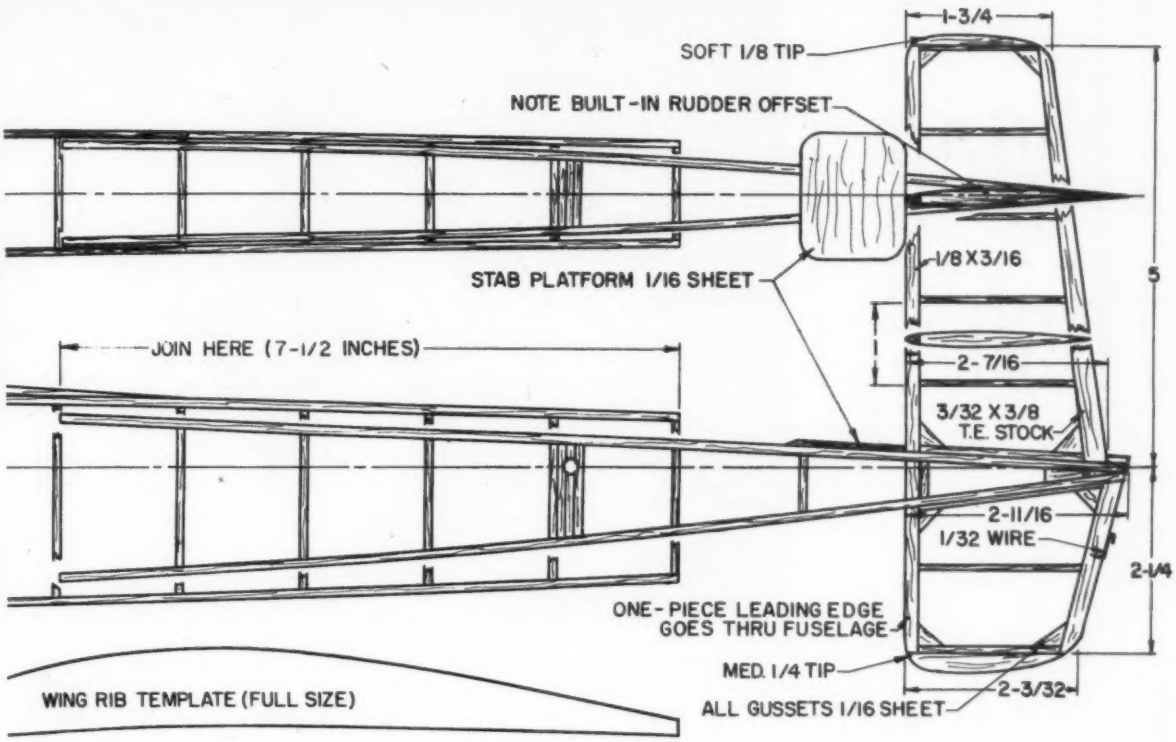
▸ The 1953 AMA rules introduce a new and interesting rubber-powered model—the "limited 200". The limitations consist simply of a minimum required weight of 5 oz. and a maximum projected wing-plus-horizontal-tail-area of 200 sq. in.

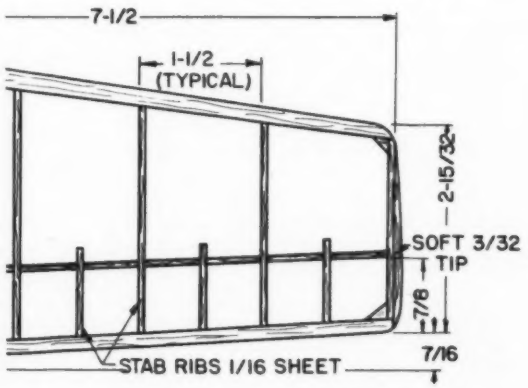
The *AMAzer 200* is so named for a purpose—its performance is amazing: in dead air, this ship does an honest 3-1/2 to 4 minutes. Construction is simple and fast, so if you want a lot of flying in return for a little building time and very little expense, let's start.

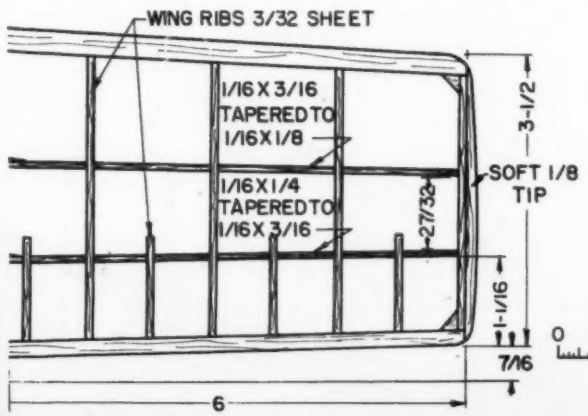
The most important single component of a high-performance rubber-powered model is the prop. Select the softest block available for blades. Cut block diagonally as shown in drawings, and carve blades with straight-grained edges for the leading edges. Note particularly that the blades are much thicker in section than the conventional rubber prop and have less undercamber. They incorporate, in fact, a good low-Reynolds-number wing section—the same section as that used in the wing (prop operates at almost exactly the same Reynolds number as the wing, and at about the same section lift coefficient, so why not?). Results indicate that this prop delivers more thrust per unit of motor torque at given rpm, in addition to requiring less motor torque. An indication of this is the fact that, with only 12 strands of 1/4 flat T-56, the 16-1/4" diameter, 22" pitch prop affords a very fast climb.

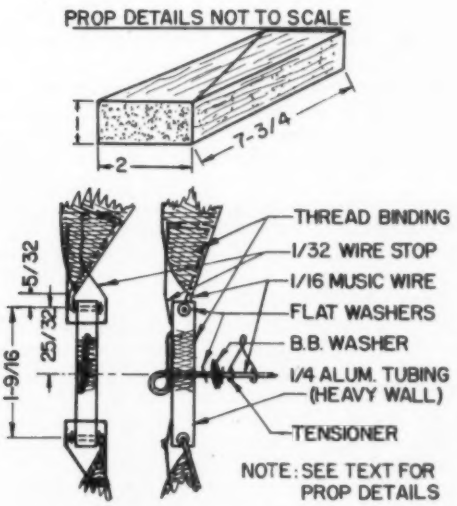
The type prop hub shown is very durable, and affords lower drag with blades folded than the conventional prop. Bend the 1/16 wire hinges, and mount in 1/16 holes drilled in the 1/4 aluminum tubing hub. Retain with flat washers soldered in place, then insert hinges (*Continued on page* 53)


1/2
3/4
3 DEG. DOWNTHRUST,
2 DEG. RIGHT, BUILT IN NOSEBLOCK
(HEAVILY CEMENT 1/16 I.D. BRASS BUSHING IN BLOCK)
WING RESTS 1/16 SHEET
3/8
7/8
11/16
1-1/16
1-11/16
1/32 SHEET FILL
1-1/2
(TYPICAL)
MED. HARD 3/32 SQ. LONGERONS
MED. SOFT 3/32 SQ. CROSS-MEMBERS
TRIM PROP BLADES TO THIS TEMPLATE AFTER ROUGHING OUT PITCH
NOTE OFFSET IN RUDDER SLOT
1/32 WIRE HOOK
TYPICAL STAB. RIB (SEE TEXT)
1/16 X 3/16
TAPERED TO
1/16 X 3/32
4
ALL GUSSETS
1/16 SHEET
TYPICAL WING RIB
(SEE TEXT)
3/32 X 3/8 T.E. STOCK (SEE TEXT)
1-1/2
(TYPICAL)
3/16 SQ.
1/16
C.G.
1/16 X 1/4
TAPERED TO
1/16 X 3/16
2
1/16
3/32 SHEET
BUTT PLATES
5
1-11/16
3/32 X 5/16
TAPERED TO
3/32 X 1/4
3/16 SQ.
1-5/16
12-3/32









AMAzer

SCALE IN INCHES (EXCEPT WHERE NOTED)
0 1 2 3 4 5 6

flying fish

by Dick Ealy

Skimming over the waves—well, ripples—*Flying Fish* is much faster than ordinary boats. Won't spin in, either, which may explain junior's big smile. The .049 *Wasp* is shown. Note pusher type propeller.

A fast, air propelled boat that should brighten the eyes of boat fans and frustrated r. o. w. 'ers.

▸ *Flying Fish* is an air-propelled, single step bottom boat that zips along the wave tops much faster than the conventional boat. Best of all, it is simple to build and uses any of the AA class motors for power. No expensive parts, such as flywheels, universal joints, stuffing box, strut and water propeller, are needed. A pusher propeller can be made simply by taking a 5-1/2" dia. Baker aluminum propeller and reversing pitch by bending at the hub. A *Wasp* .049 was used on the original boat.

Start construction by cutting two balsa sides from 1/16" thick balsa. Pattern can be taken from sideview by tracing with paper. Follow inside dotted lines along upper and lower sides, but note in top view that sides cover end bulkheads A and F. Cut out main hull bulkheads from 1/16" sheet balsa and cement in place between side panels. Easiest way to assemble is to place bottom C to F on work table, allowing step at C to overhang table edge and nose to point away from table.

When frame is dry, plank with 1/16 x 3" sheet balsa, grain running crossways. Next cement soft balsa side blocks 1-3/8 x 1-1/2 x 12" to sides of hull. Then cement soft balsa nose block 11/16 x 1-5/8 x 5-1/2" and tail block 3/8 x 1-3/16 x 6-5/8" in place as shown. Nose and tail blocks are carved to fit profile as shown. In top view, see line X for outer edge line. Carve this outline on hull. Note in bulkhead cross-section C the 30 degree angle out which produces line Y and Z when carved next.

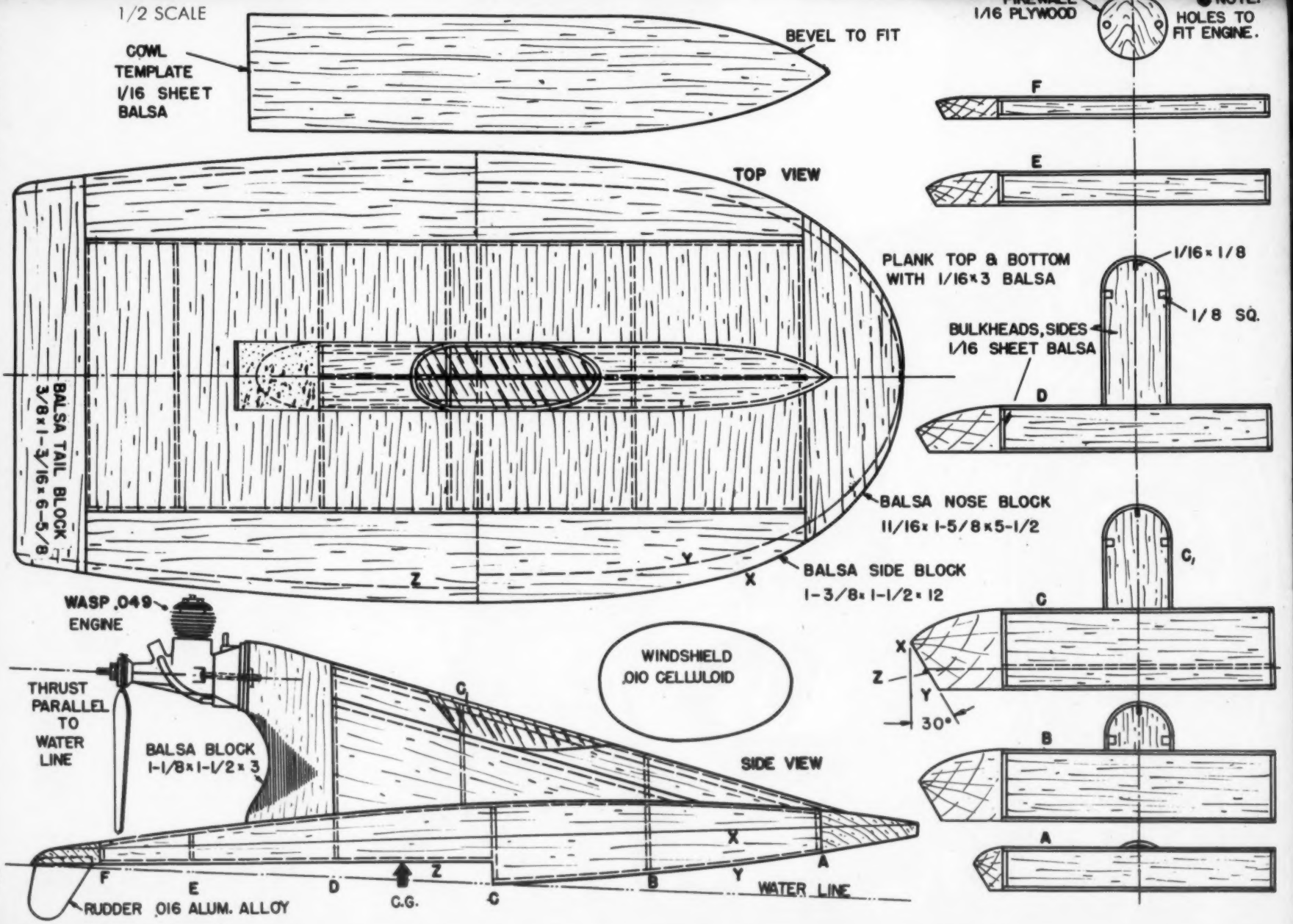
Round the side blocks on top side by carving. Sandpaper hull smooth with 2/0 and then #400. Make cowl next. Cut out bulkheads B, C1, and D, cementing them in proper place. Add 1/16" x 1/8" top balsa stringer and 1/8" x 1/8" balsa side stringers. See template for making cowl top out of 1/16" sheet balsa.

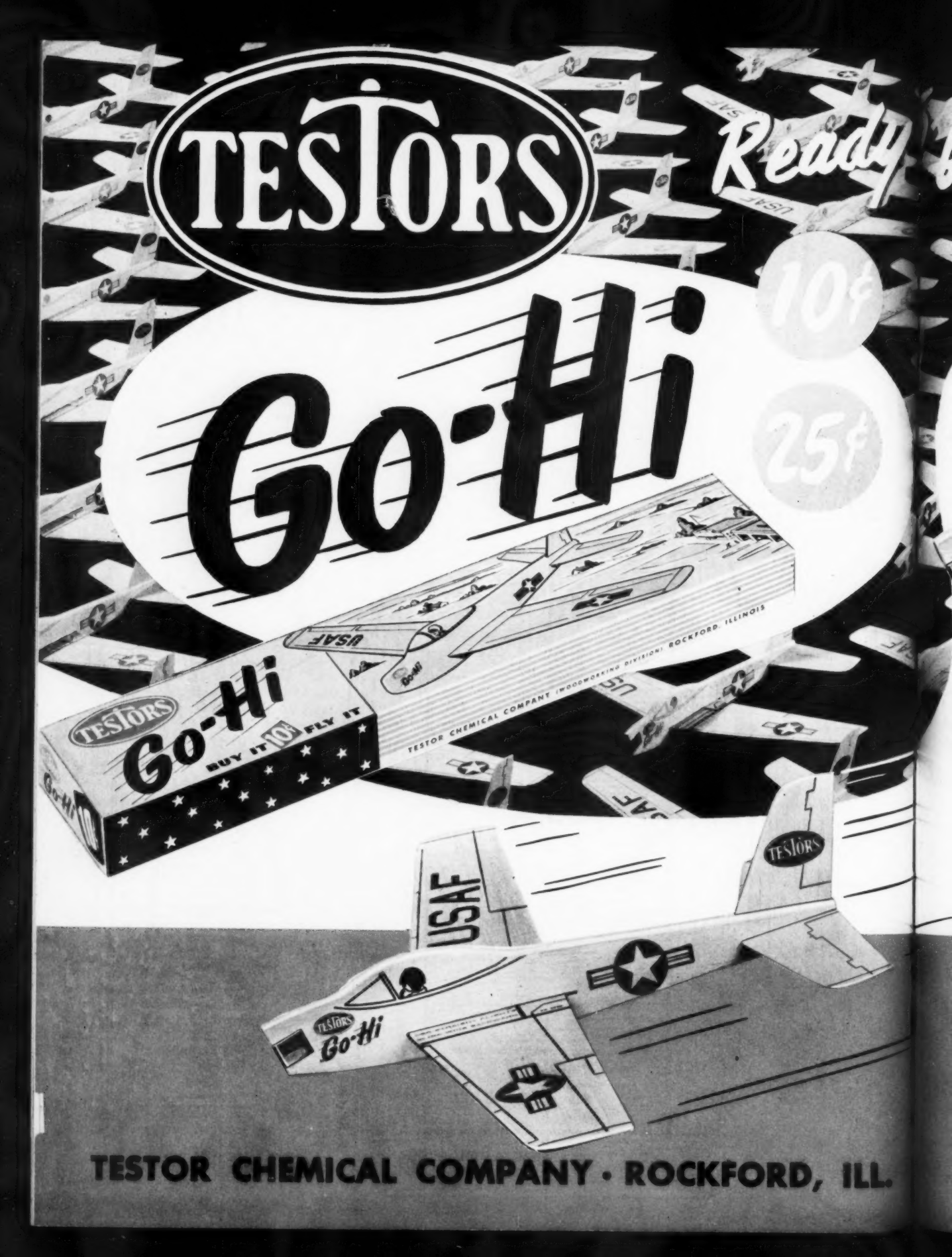
Soak this blank in hot water for five minutes and bend cowl frame. Hold in place with masking tape while drying over gas flame. When dry cement in place. Fit 1/16" side pieces in place and cement. Cut out top of cowl for cockpit.

Attach 1-1/8 x 1-1/2 x 3" balsa block at cowl rear and cement in place. Firewall is made to fit your engine. The one in the drawing fits a *Wasp*. Use 1/16" plywood. Bolt engine to firewall, gouge out balsa block to allow flush fit, then cement nuts on back side. Allow to dry and remove engine and bolts. Now attach firewall using Weldwood glue. Carve block to fit firewall and profile view as shown. Sand cowl unit smooth with 2/0 and then #400. Make .016 thick aluminum rudder and cut a slot with razor in center of ship at rear for mounting. Cement in place.

Fill the balsa pores by brushing on four coats of Testor sanding sealer, sanding between each coat with #400. Brush on three coats of Testors red dope and repeat sand- (*Continued on page* 50)

No additional parts to buy. Eliminated are flywheel, universal joint, stuffing box, strut and water propeller. Assembling hull is like assembling sheet fuselage, even if the shape seems different!


1/2 SCALE
COWL TEMPLATE 1/16 SHEET BALSA
BEVEL TO FIT
TOP VIEW
BALSA TAIL BLOCK 3/8 x 1-3/16 x 6-5/8
Z
Y
X
PLANK TOP & BOTTOM WITH 1/16 x 3 BALSA
BULKHEADS, SIDES 1/16 SHEET BALSA
1/16 x 1/8
1/8 SQ.
BALSA NOSE BLOCK 11/16 x 1-5/8 x 5-1/2
BALSA SIDE BLOCK 1-3/8 x 1-1/2 x 12
WASP .049 ENGINE
THRUST PARALLEL TO WATER LINE
BALSA BLOCK 1-1/8 x 1-1/2 x 3
WINDSHIELD .010 CELLULOID
SIDE VIEW
RUDDER .016 ALUM. ALLOY
C.G.
WATER LINE
FIREWALL 1/16 PLYWOOD
NOTE: HOLES TO FIT ENGINE.
F
E
D
C
C1
B
A
30°


TESTORS
Ready
10¢
25¢
Go-Hi
TESTOR CHEMICAL COMPANY (WOODWORKING DIVISION) ROCKFORD, ILLINOIS
TESTORS
Go-Hi
BUY IT 10¢ FLY IT
USAF
TESTORS
TESTORS
Go-Hi
TESTOR CHEMICAL COMPANY • ROCKFORD, ILL.

Fly... Ready for fun!

Hand-Launched Airplanes...10¢ and 25¢

Two great planes . . . and you'll want to collect a whole air fleet of 'em! They're accurately balanced for best flight performance . . . do loops, circles, high soaring . . . are easy to stunt. Made of choice, strong Testors balsa with realistic 2-color printed trim. Can be assembled in 30-seconds without cementing. Individually boxed to protect parts . . . complete with launching and flying instructions. Start your fleet today . . .

★ 10c Go-Hi: wingspan — 12"; overall length — 9"
★ 25c Go-Hi: wingspan — 18"; overall length — 12"

INSIST ON THESE OTHER TESTORS MODEL SUPPLIES . . . by name

TESTORS MODEL AIRPLANE CEMENTS

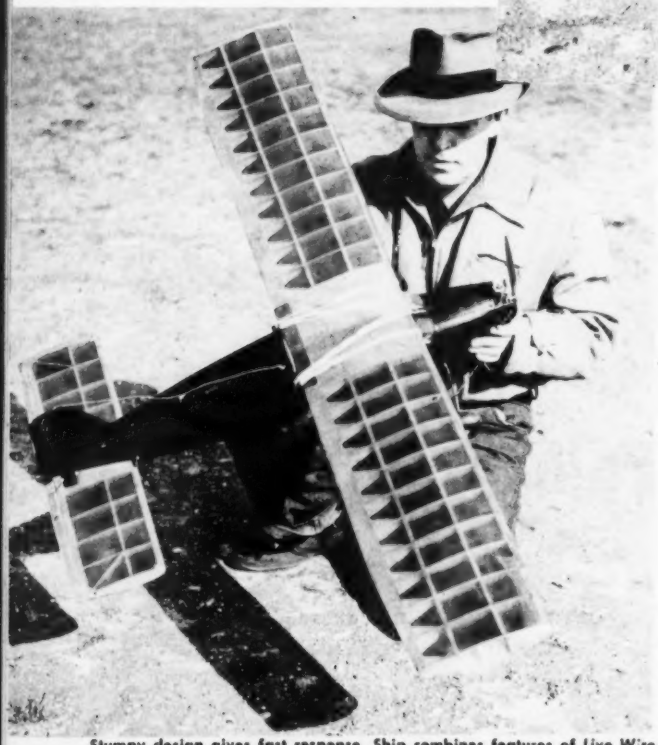
TESTORS DOPE

TESTORS
LITTLE DIPPER 50¢
BIG DIPPER $1.00

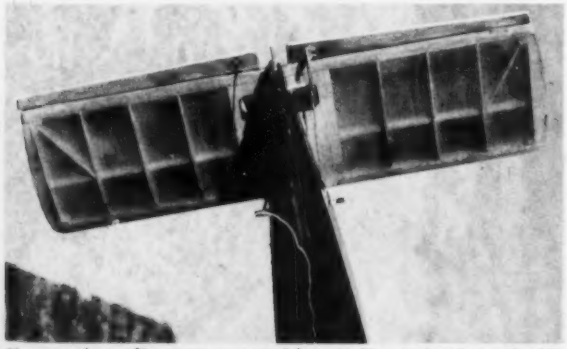
Acrobat

With rudder and elevator control, this sturdy little rc job does tight loops, Immelmans, true stalls, and flew inverted. Fine on rudder only.

With a span of only 54 inches and an area of 475 sq. in. this is a "minimum" plane. With flippers in use wing must be securely tied down.



Stumpy design gives fast response. Ship combines features of *Live Wire* with *Windy Joe*, flies more like former only faster. Sheet fuselage.



Close-up shows flipper area, control horn in U-control style, and solder counterweight necessary for easy elevator operation. Silk covering.

▶ The *Acrobat* is a small (less than 4-1/2 feet) radio job, utilizing two controls by means of the Bonner compound escapement to give both rudder and elevator on a single channel. Although the plane weighs three pounds 11 ounces, it is on the fast, peppy side when powered with the *Cub* 14 a 9 x 6 Power Prop, and a good fuel. Tight consecutive loops, vertical dives, true stalls, and even brief inverted flights have been achieved.

However, the combination of rudder and elevator is not for the beginner in rc and is recommended only for an experienced flier who has quick reactions and can anticipate the performance of a plane in various maneuvers. The beginner should fly with rudder alone; the moderately experienced pilot should leave the elevator mechanism disconnected until he is familiar with the ship and only then gingerly begin to feel out the flippers.

Anyone capable of building an rc job will not need construction details; instead let's concentrate on the control systems and how to fly the plane. It is imperative that the radio, escapements, and linkages be in perfect order at all times and, secondly, the operator must be positive that he can obtain any desired control without mistakes. The finished plane should be bench tested until it is obvious that the system works perfectly and reliably, and that the flier can work either a beep box, ground control switch or microswitch without picking up the wrong controls. It is particularly important that the compound escapment by thoroughly checked out and that the proper rubber size and length be determined for your ship, as well as the range of turns in the rubber that provide safe operation.

There is a possibility for a compound escapement to hang up on the third position (the electrical contact then being closed to operate the second escapement) on 1/8" rubber. Should this occur in flight, any subsequent pulses to obtain rudder will give up and down elevator instead. We relieved the pressure and drag on this contact as much as possible without interfering with its proper functioning and used 3/16" rubber. With 3/16" rubber it is necessary to pulse the control switch as rapidly as possible; the speed can be obtained and practiced in bench tests. When these things have been worked out, the safety of the plane thereafter depends on reliable operation of the radio. Whereas a bad radio can spin in a rudder only job, it may dive in a flippered ship.

The receiver in the pictures is the Miller from the January 1953 issue, assembled on one side of the chassis to permit an installation that is both crashproof and quickly interchangeable for more than one airplane. Other receivers also may be used, such as the Aerotrol, the McNabb 27, and Control Research two-tuber. The available cabin space may be rather confined for the McNabb 465.

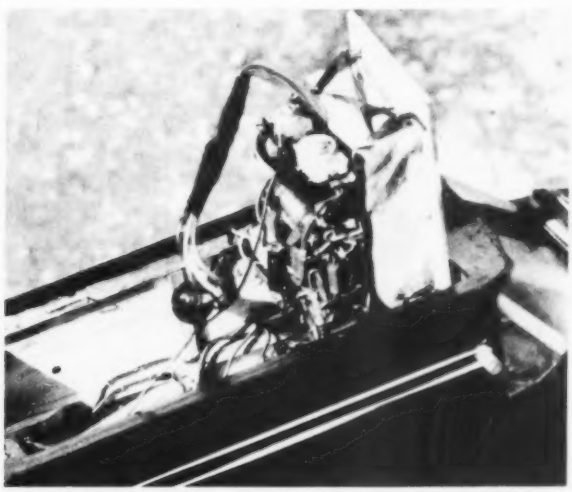
The battery installation consists of two Hillcrest plastic boxes each holding four pencells, and any hearing aid B batteries, (or up to a 67 volt K45 as shown). One Hillcrest box (four batteries) was used for escapements (when the third control operates, two escapements are being held in), and the other for the A supply. Two pencells are sufficient, but four can be carried with no ill effects and allow several weeks flying without replacement. It is desirable to maintain a wing loading of about 18 ounces per square foot.

The compound escapement is located in the rear of the fuselage, forward of the fin. The elevator escapement is in the rear of the cabin. Bonner's literature describes the wiring and use of these escapments. In brief, one pulse gives right rudder on the compound, two gives left, and three gives the added control.

The ship should be hand glided until it has a fast glide, touching down two point. It should appear slightly nose heavy at this point. Make the first power tests on short runs with prop reversed. Measure the fuel for test hops. Do not use elevator at any time in tests. The plane should always be flown like a rudder only job, calling on the elevators only when the plane is positioned in the air for a special maneuver which has been planned ahead of time. Stall approaches should be broken by rudder, never by elevator. (This does not apply to reed radios like Rockwood which give smoother response than is possible by repeated applications of three impulses.)

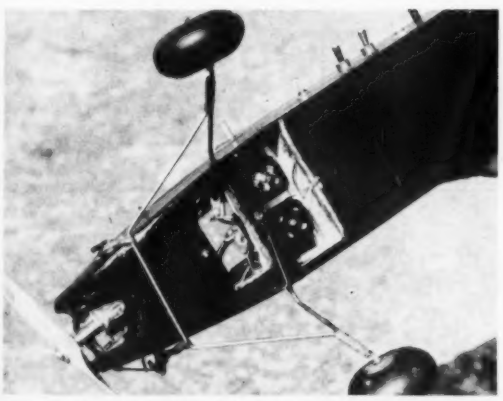
Before launching make sure that up elevator is the next flipper position. To eliminate having to remember elevator sequence, always use down briefly after up, in order to restore the up-next condition. Thus, if a spiral is performed on rudder, up elevator can be used in the pull out to produce a clean loop. Unless you want to perform a dive next, the down elevator position should be applied but not held, to return the escapement to up next. If a dive out of straight flight is desired run off the up position then hold down. The pull out will be a clean loop without elevator, but brief application of up will make the ship loop like a stunt U-control plane. (*Continued on page* 46)

Landing gear pivots back to absorb shock. Rubber wraps around dowels. Idea used by Dick Schumacher. Lightweight air wheels.

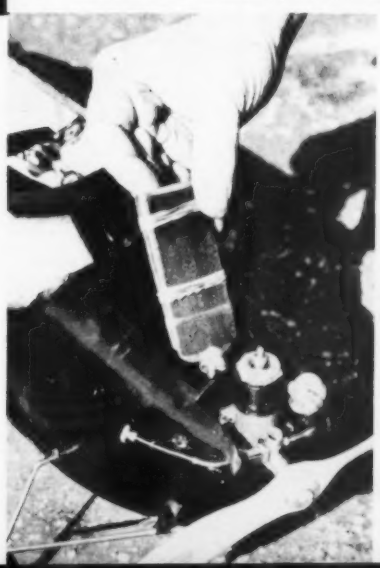


Receivers built on one side of chassis may be mounted on foam on a slip board fitting into grooves, resting against a solid bulkhead. Miller shown.

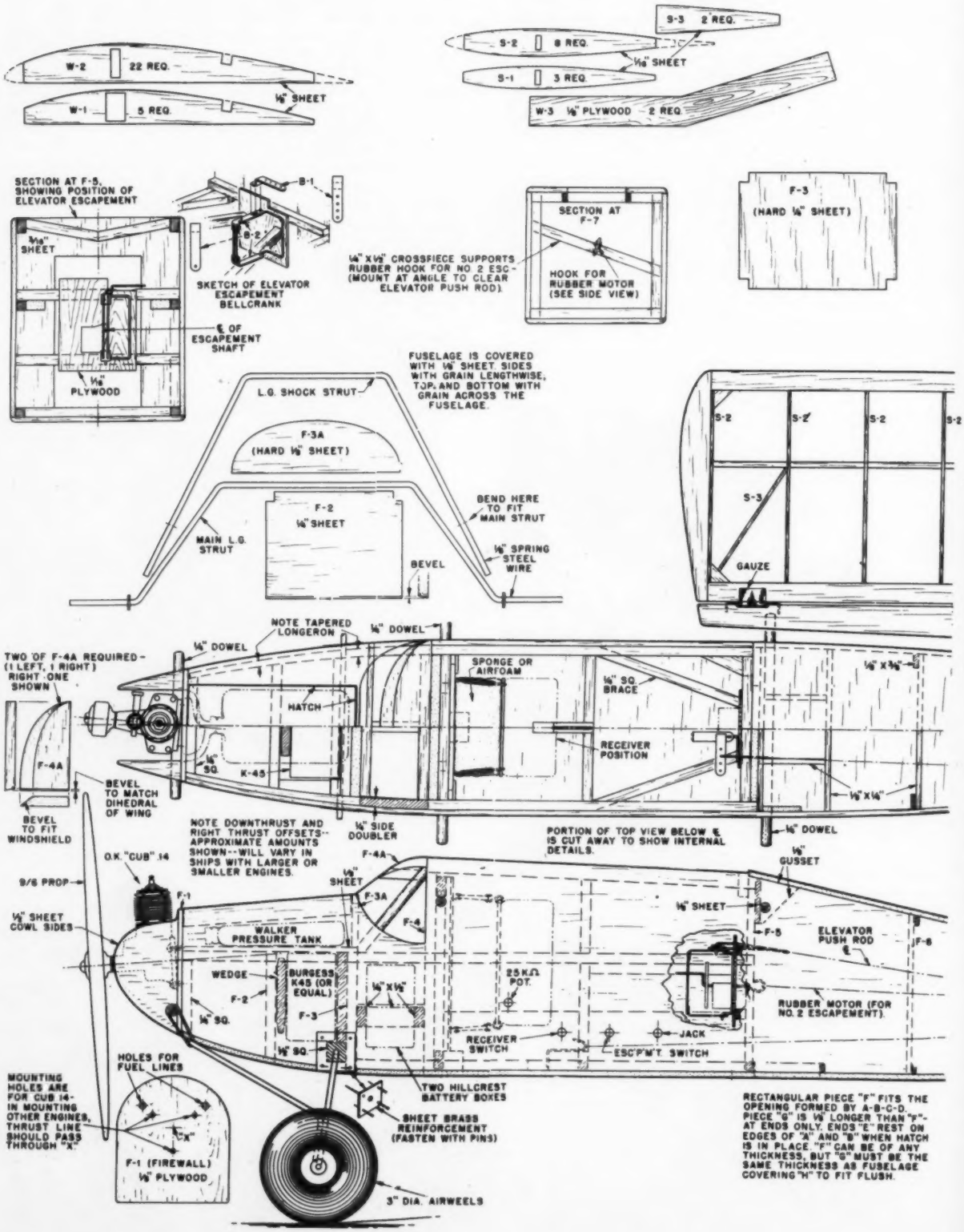
Below: Left—Walker tank is folded over between ply sheets; Right—The elevator escapement and part of linkage visible at rear of the cabin.



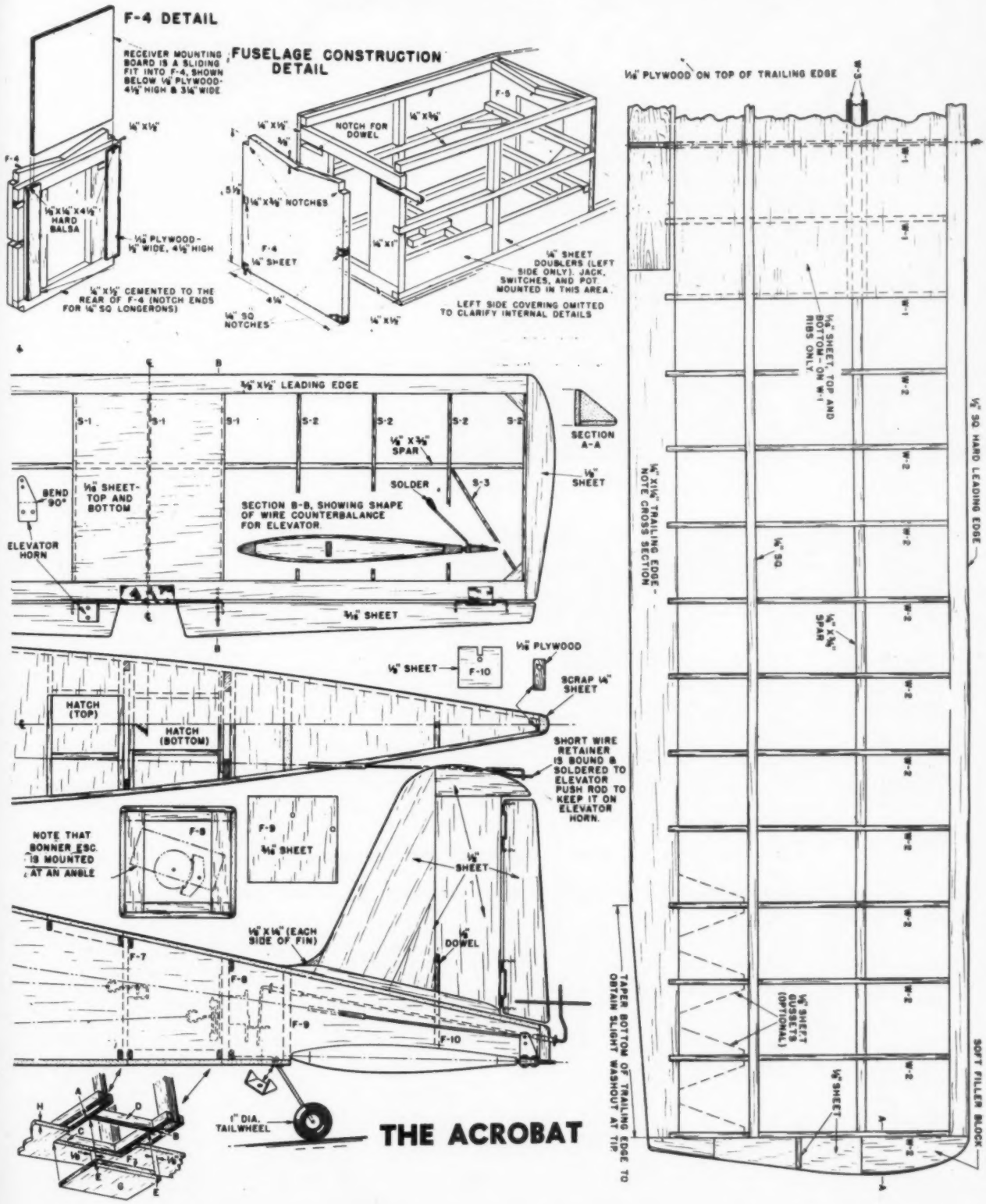
Access hatches here removed to show location of B battery compartment and side-by-side location of Hillcrest plastic boxes.



FULL SIZE PLANS OF THE ACROBAT AND E. J. BROWN'S CQ


W-2 22 REQ.
W-1 5 REQ.
1/16" SHEET
S-3 2 REQ.
S-2 8 REQ.
1/16" SHEET
S-1 3 REQ.
W-3 1/8" PLYWOOD 2 REQ.
SECTION AT F-5, SHOWING POSITION OF ELEVATOR ESCAPEMENT
3/16" SHEET
B-1
B-2
SKETCH OF ELEVATOR ESCAPEMENT BELLCRANK
℄ OF ESCAPEMENT SHAFT
1/16" PLYWOOD
1/4" X 1/8" CROSSPIECE SUPPORTS RUBBER HOOK FOR NO 2 ESC - (MOUNT AT ANGLE TO CLEAR ELEVATOR PUSH ROD)
SECTION AT F-7
HOOK FOR RUBBER MOTOR (SEE SIDE VIEW)
F-3 (HARD 1/4" SHEET)
FUSELAGE IS COVERED WITH 1/8" SHEET SIDES WITH GRAIN LENGTHWISE, TOP AND BOTTOM WITH GRAIN ACROSS THE FUSELAGE.
L.G. SHOCK STRUT
F-3A (HARD 1/8" SHEET)
F-2 1/8" SHEET
BEND HERE TO FIT MAIN STRUT
MAIN L.G. STRUT
BEVEL
1/8" SPRING STEEL WIRE
S-2
S-3
GAUZE
NOTE TAPERED LONGERON
1/4" DOWEL
1/4" DOWEL
TWO OF F-4A REQUIRED - (1 LEFT, 1 RIGHT) RIGHT ONE SHOWN
F-4A
BEVEL TO MATCH DIHEDRAL OF WING
BEVEL TO FIT WINDSHIELD
HATCH
SPONGE OR AIRFOAM
1/8" SQ. BRACE
RECEIVER POSITION
1/8" SQ.
K-45
1/8" X 1/8"
1/8" X 1/4"
NOTE DOWNTHRUST AND RIGHT THRUST OFFSETS-- APPROXIMATE AMOUNTS SHOWN--WILL VARY IN SHIPS WITH LARGER OR SMALLER ENGINES.
1/4" SIDE DOUBLER
PORTION OF TOP VIEW BELOW ℄ IS CUT AWAY TO SHOW INTERNAL DETAILS.
1/4" DOWEL
O.K. "CUB" 14
9/6 PROP
F-1
1/4" SHEET COWL SIDES
F-4A
1/8" SHEET
F-3A
F-4
1/8" GUSSET
1/8" SHEET
F-5
ELEVATOR PUSH ROD
F-6
WALKER PRESSURE TANK
WEDGE
BURGESS K45 (OR EQUAL)
F-2
1/4" SQ.
F-3
1/4" X 1/4"
25 K Ω POT.
RUBBER MOTOR (FOR NO. 2 ESCAPEMENT)
RECEIVER SWITCH
JACK
ESC'P'M'T. SWITCH
1/4" SQ.
HOLES FOR FUEL LINES
MOUNTING HOLES ARE FOR CUB 14- IN MOUNTING OTHER ENGINES, THRUST LINE SHOULD PASS THROUGH "X"
"X"
F-1 (FIREWALL) 1/8" PLYWOOD
TWO HILLCREST BATTERY BOXES
SHEET BRASS REINFORCEMENT (FASTEN WITH PINS)
3" DIA. AIRWEELS
RECTANGULAR PIECE "F" FITS THE OPENING FORMED BY A-B-C-D. PIECE "G" IS 1/8 LONGER THAN "F"- AT ENDS ONLY. ENDS "E" REST ON EDGES OF "A" AND "B" WHEN HATCH IS IN PLACE. "F" CAN BE OF ANY THICKNESS, BUT "G" MUST BE THE SAME THICKNESS AS FUSELAGE COVERING "H" TO FIT FLUSH.

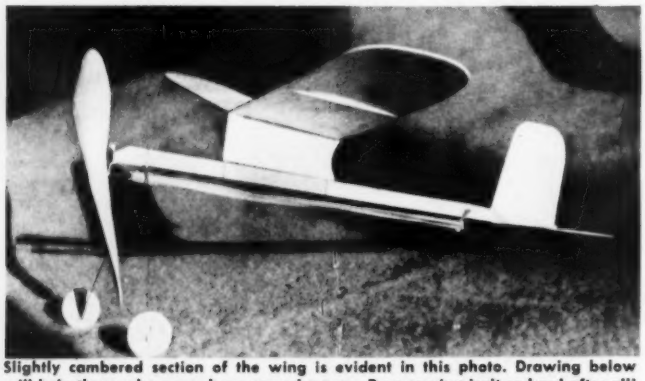
RADIO CONTROL MODELS ARE AVAILABLE. SEE PAGE 52.


F-4 DETAIL
RECEIVER MOUNTING BOARD IS A SLIDING FIT INTO F-4, SHOWN BELOW 1/8" PLYWOOD - 4 1/2" HIGH & 3 1/4" WIDE
1/4" X 1/2"
F-4
1/2" X 1/4" X 4 1/2" HARD BALSA
1/2" PLYWOOD - 1/2" WIDE, 4 1/2" HIGH
1/4" X 1/2" CEMENTED TO THE REAR OF F-4 (NOTCH ENDS FOR 1/4" SQ LONGERONS)
FUSELAGE CONSTRUCTION DETAIL
NOTCH FOR DOWEL
1/4" X 3/8"
F-5
1/4" X 1/2"
3/8"
1/2"
1/4" X 3/8" NOTCHES
F-4
1/4" SHEET
1/4" X 1"
1/4" SHEET DOUBLERS (LEFT SIDE ONLY). JACK, SWITCHES, AND POT MOUNTED IN THIS AREA.
LEFT SIDE COVERING OMITTED TO CLARIFY INTERNAL DETAILS
1/4" SQ NOTCHES
1/4" X 1/2"
1/16" PLYWOOD ON TOP OF TRAILING EDGE
W-1
W-2
1/16" SHEET, TOP AND BOTTOM ON W-1 RIBS ONLY
1/2" SQ HARD LEADING EDGE
1/4" SQ
1/4" X 3/4" SPAR
1/4" X 1 1/4" TRAILING EDGE - NOTE CROSS SECTION
1/16" SHEET GUSSETS (OPTIONAL)
1/16" SHEET
SOFT FILLER BLOCK
TAPER BOTTOM OF TRAILING EDGE TO OBTAIN SLIGHT WASHOUT AT TIP
1/2" X 1/2" LEADING EDGE
S-1
S-2
S-3
1/8" X 3/8" SPAR
SECTION A-A
1/16" SHEET
BEND 90°
1/16" SHEET - TOP AND BOTTOM
SOLDER
SECTION B-B, SHOWING SHAPE OF WIRE COUNTERBALANCE FOR ELEVATOR.
ELEVATOR HORN
1/16" SHEET
1/16" PLYWOOD
1/16" SHEET
F-10
SCRAP 1/4" SHEET
HATCH (TOP)
HATCH (BOTTOM)
SHORT WIRE RETAINER IS BOUND & SOLDERED TO ELEVATOR PUSH ROD TO KEEP IT ON ELEVATOR HORN.
NOTE THAT BONNER ESC. IS MOUNTED AT AN ANGLE
F-8
F-9
1/16" SHEET
1/16" SHEET
1/4" X 1/4" (EACH SIDE OF FIN)
1/8" DOWEL
F-7
F-8
F-9
F-10
1" DIA. TAILWHEEL
THE ACROBAT

tiny Mite

by PAUL PLECAN

A sharp razor, shiny balsa wood, fine sandpaper is a combination no modeler can resist. A clever clip arrangement on the pylon allows shifting of the wing.



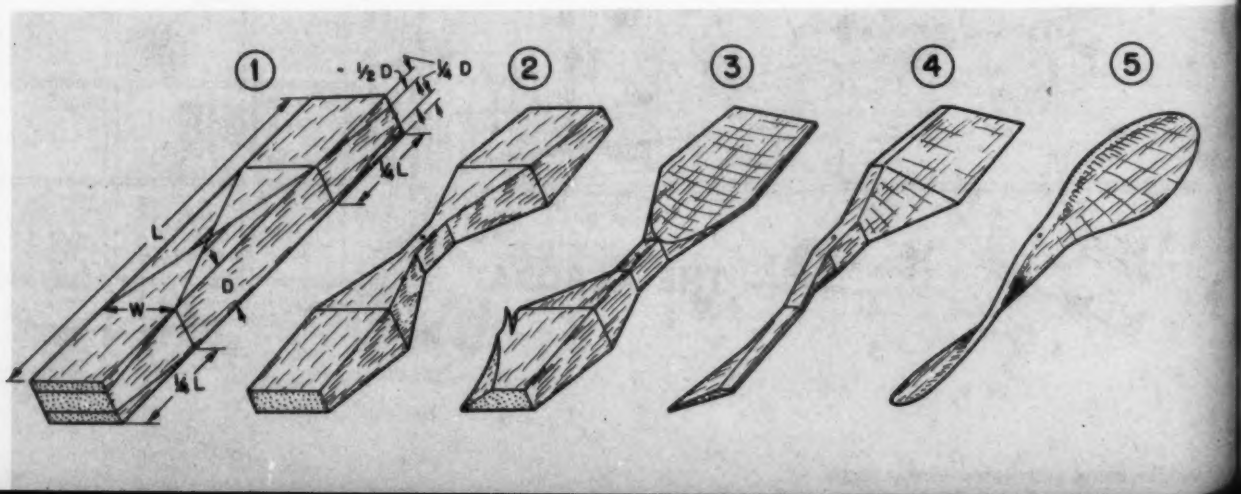
Slightly cambered section of the wing is evident in this photo. Drawing below will help those who never have carved a prop. Prop carving isn't so hard after all!

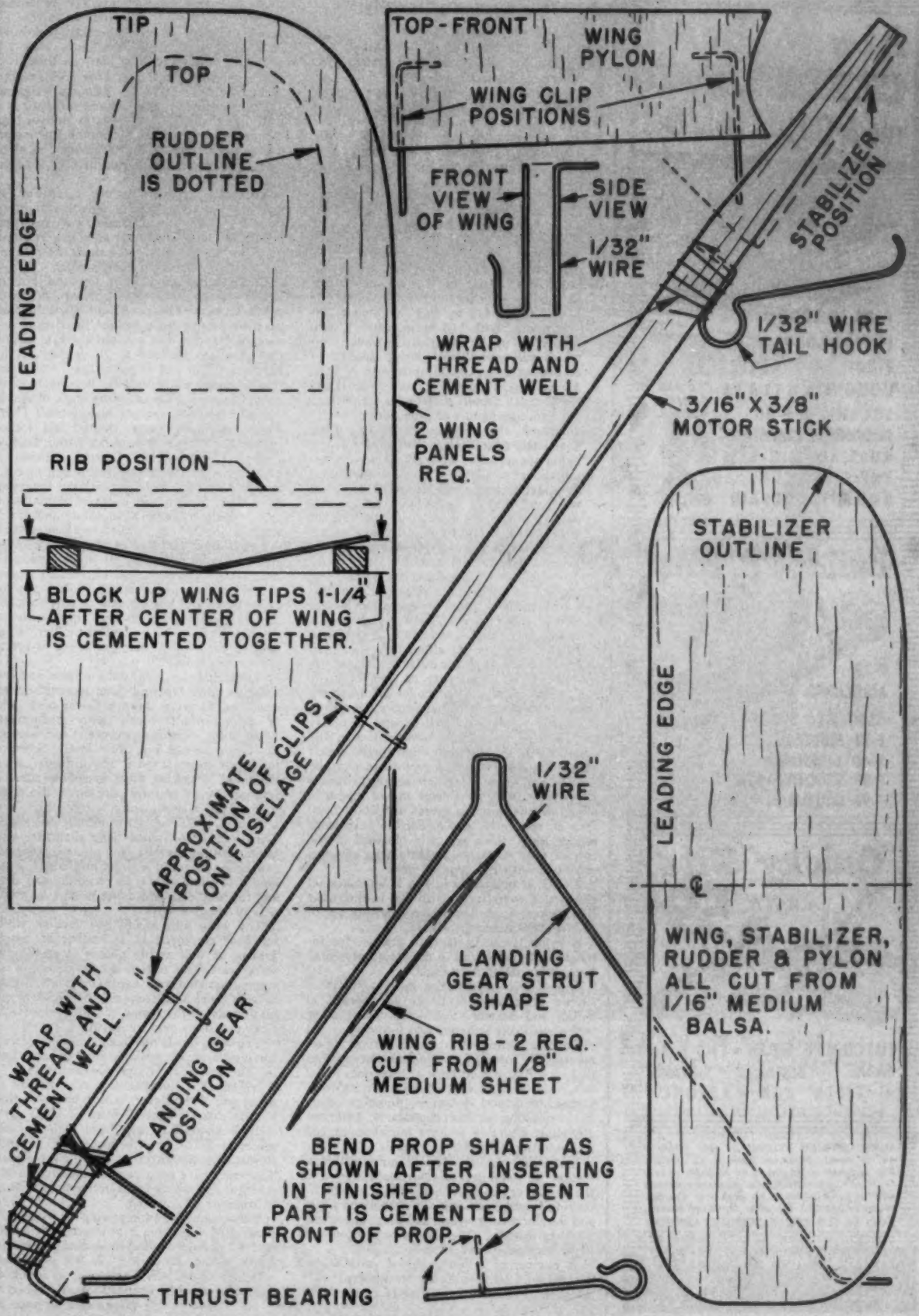
Tiny Mite is a swell little flier and you can get one into the air in just a few hours. To start, you'll need some 1/32" wire (two feet of it), a strip of hard 3/16" x 3/8" balsa 12" long, a sheet of 1/16" x 3" x 36" medium balsa, and a prop block 3/4" x 1-1/4" x 7" (a light machine-cut prop will do if you can't carve one). Also a pair of 3/4" or 1" wheels, a few washers about 3/16" in diameter, a yard of 1/8" flat T-56 rubber, some ordinary thread, and a tube of cement. A small jar of clear dope will come in handy for slicking up the prop and for reinforcing cemented areas, but you can get by without it if you so please.

Once all the wire parts are bent to conform with the full-size patterns shown, (you will need needle-nose pliers for doing this) proceed with the motor stick. Cement the thrust bearing, landing gear strut and tail hook in place, then bind with thread (six or eight turns). Note that the top end of the tail hook goes through a hole in the motor stick, as the joint here must be strong enough to hold the hook against the pull of the wound-up rubber motor. A second and third coat of cement over the thread-wrapped wire parts is a real necessity.

Cut all the flying surfaces from medium 1/16" sheet and cement in place as shown by the photo of the assembled model. Note how the wing tips are blocked up 1-1/4" at each tip for dihedral right after cementing the two panels together. After the cement has dried, add the pylon under the wing. More cement is needed at this joint, but add very sparingly, and at small sections at a time. If the entire wing seam between the panels is given a second coat, the preceding coat will soften and the dihedral angle may change, so remember to add just a 1/4" or 1/2" to the seam at a time. Note that wire "wing clips" are cemented to the pylon at the front and rear. Bend the lower parts of these so that they grip the motor stick quite firmly, yet can be (*Continued on page* 40)

An all-balsa r.o.g with exceptional performance. Can be built in a few hours time, material cost low. Always ready to go, it's a nice job to have around.

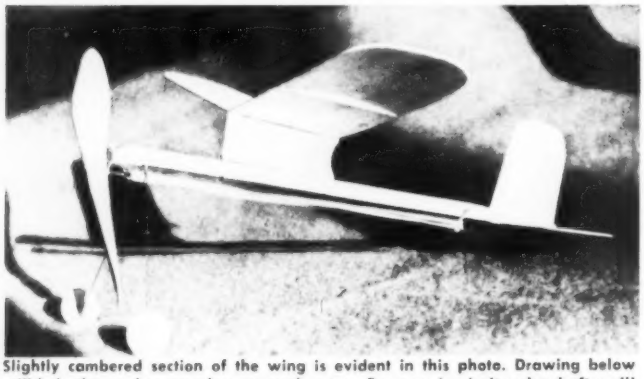



TIP
TOP
RUDDER OUTLINE IS DOTTED
LEADING EDGE
RIB POSITION
BLOCK UP WING TIPS 1-1/4" AFTER CENTER OF WING IS CEMENTED TOGETHER.
TOP-FRONT WING PYLON
WING CLIP POSITIONS
FRONT VIEW OF WING
SIDE VIEW
1/32" WIRE
STABILIZER POSITION
1/32" WIRE TAIL HOOK
WRAP WITH THREAD AND CEMENT WELL
3/16" X 3/8" MOTOR STICK
2 WING PANELS REQ.
STABILIZER OUTLINE
LEADING EDGE
APPROXIMATE POSITION OF CLIPS ON FUSELAGE
1/32" WIRE
LANDING GEAR STRUT SHAPE
WING RIB - 2 REQ. CUT FROM 1/8" MEDIUM SHEET
WING, STABILIZER, RUDDER & PYLON ALL CUT FROM 1/16" MEDIUM BALSA.
WRAP WITH THREAD AND CEMENT WELL.
LANDING GEAR POSITION
BEND PROP SHAFT AS SHOWN AFTER INSERTING IN FINISHED PROP. BENT PART IS CEMENTED TO FRONT OF PROP.
THRUST BEARING

tiny Mite

by PAUL PLECAN

A sharp razor, shiny balsa wood, fine sandpaper is a combination no modeler can resist. A clever clip arrangement on the pylon allows shifting of the wing.



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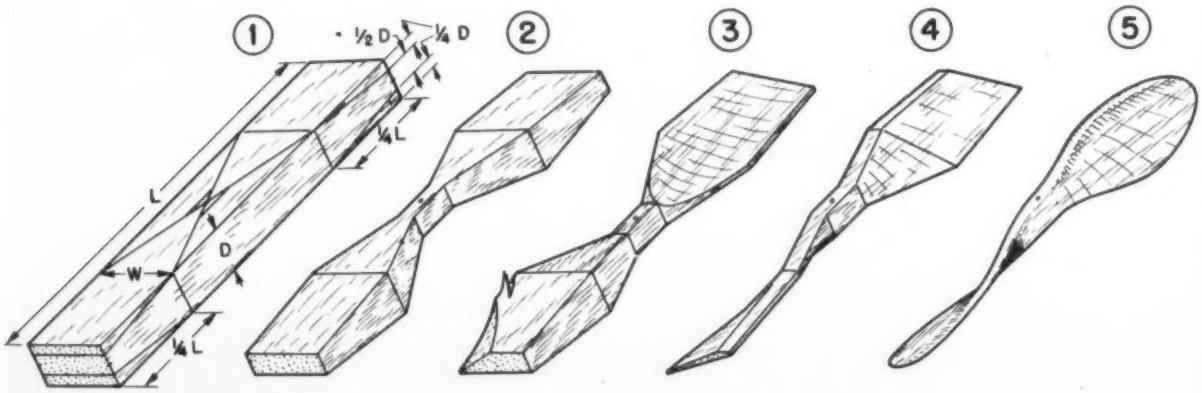

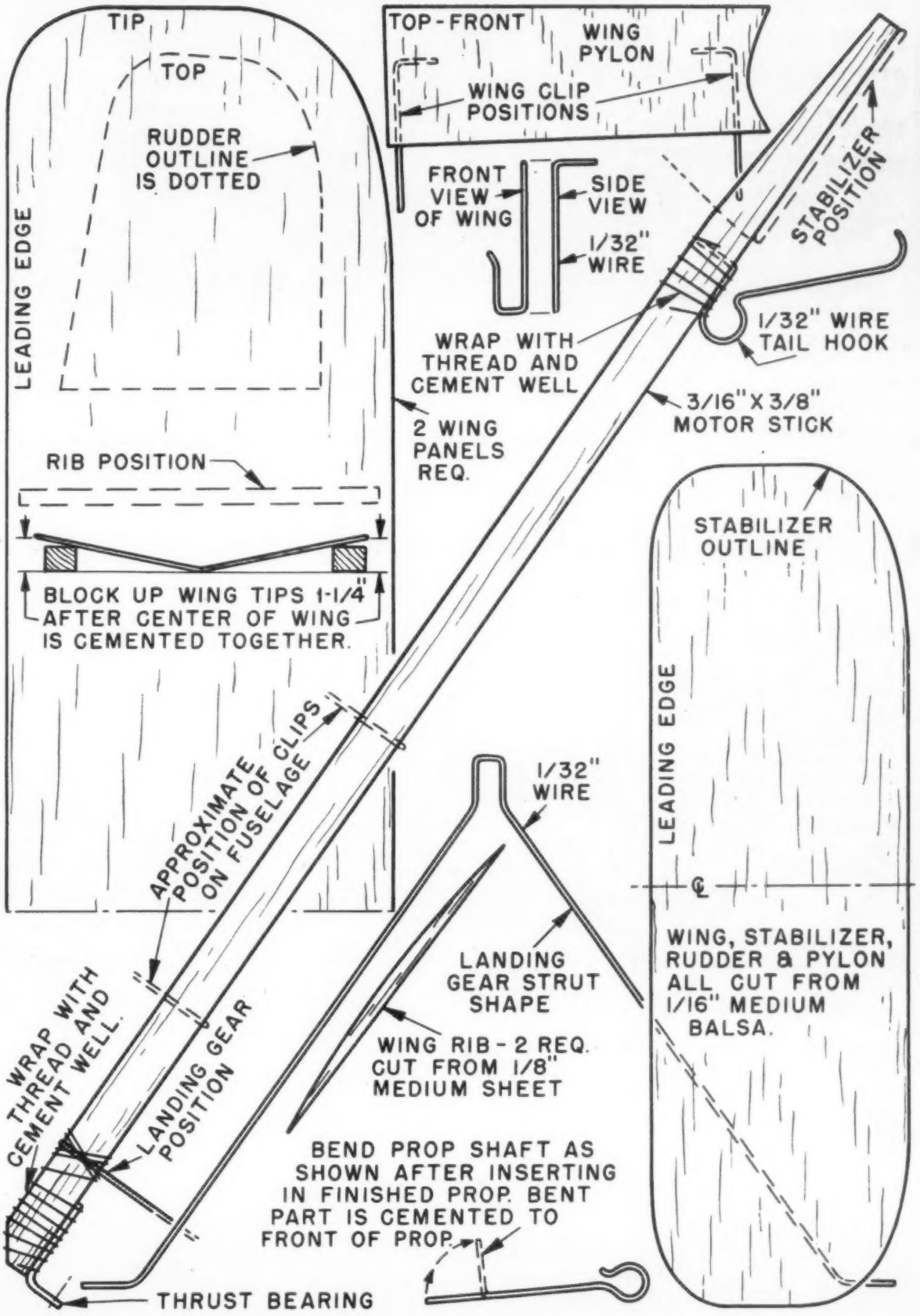
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WRAP WITH THREAD AND CEMENT WELL.
LANDING GEAR POSITION
BEND PROP SHAFT AS SHOWN AFTER INSERTING IN FINISHED PROP. BENT PART IS CEMENTED TO FRONT OF PROP.
THRUST BEARING

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The Internationalist

(Continued from page 18)

proportionately smaller, although it is generally admitted that 2.5 cc. displacement is to be preferred. Similarly, our 2.5 cc. job could aim at the lowest possible sinking speed by using maximum area permitted by the surface loading rule, i.e. around 650 sq. in. total, or we can clip areas by, say, 100 sq. in. in the expectation of a faster and higher climb.

We can summarize our line of approach as follows:

1. Two basic model sizes present themselves:
   a) to suit American .099's (1.6 cc);
   b) to suit 2.5 cc maximum displacements allowed.
2. .099 Model Specifications: Work to maximum weight allowed. For an Arden .099 this means 11-1/2 oz. Use around 400 sq. in. total area. (Maximum allowed area for 11-1/2 oz. is 421 sq. in.) We sugest 290 sq. in. wing with 116 sq. in. (40%) stab. Model will not be unduly tricky so use prop which will give utmost performance. Aim at getting over 10,000 rpm with 8 x 4.
3. 2.5 cc Model Specifications: Apart from the Cub .14 motor, there are a number of good foreign motors of high power, mostly diesels, in this displacement group. (We have lately seen the Cox *Thimbledrome .15* motor suggested as a suitable American International or Class I controline motor but, in actual fact, this engine is .1534 cu. in. which, equivalent to 2.514 cc is, unfortunately, just outside the F.A.I. limit.) Again work to maximum weight allowed. For 2.5 cc this is 17.65 cc—say 17-3/4 oz. Try to avoid letting model exceed 18 oz. Total area can be anything between 550 and 650 sq. in., is not so critical as with smaller jobs. Unless you have an exceptionally hot motor, however, it is best to keep area nearer lower figure, which will give a good balance of climb and glide.

Performance target for an International job should be four minutes on 20 seconds motor run or less and the 2.5 cc model should be the easier with which to realize such a figure but, of course, a great deal will depend on plenty of power being available from the motor. The better types of European high-speed diesels have indicated that such a performance can be reached and exceeded. Their ability to turn a prop of up to 10" diameter and of moderate blade area and pitch at speeds of 9,000-10,000 rpm is, of course, a considerable help since higher rpm, which are only obtained at the cost of prop diameter, is seldom an effective substitute with this type of model.

R.O.G. is obligatory in F.A.I. International contests. Generally, a two leg landing-gear is preferred since monowheel types are apt to be tricky in windy conditions.

A pylon layout is standard practice for International models and in the design presented here, pylon set-up is retained.

Our model follows the current trend of simple, slim, angular lines (as opposed to earlier and heavier streamlined type models with their many stringers and formers) to aid rapid construction. It is fast becoming a prerequisite of International contest participation that each flier should have at least one, if not two, reserve models and an excessively complicated structural design is, therefore, quite out of question for most contestants. Additionally, it is desirable to have model as rugged and as easily repairable as possible.

Since rules require a certain minimum cross-section, we could not carry our simplification to the extent of using a sheet pylon, except by making fuselage substantially deeper and wider and thus increasing weight and drag. Therefore, we have featured a simple built-up pylon and kept fuselage slim.

A number of different engine installations are shown. It should be remembered that weights of many 2.5 cc motors currently in production vary considerably. The advertised weight of the *Cub .14* is given as only 2-3/4 oz., whereas the twin ball-bearing, disk-valve *E. D. 2.46* weighs twice this figure. Most 2.5 cc motors fall somewhere between these two extremes, the radial mount *Elfin 2.49* (a popular contest f/f motor in Britain) weighing 3-3/4 oz., while its beam mount successor is a little less than 3-1/2 oz. It is as well to bear in mind the weight of the motor you intend using, when constructing the model, so as to avoid any excessive variation in C.G. location —normally at about 75%.

The basic fuselage structure is very simple. There are no bends in the longerons. Build up two sides over plan in usual way, inserting all diagonals except those, as noted, at front, and also fit 1/8" plywood nose doubler unless you are using a beam-mount motor.

Erect two sides and fit top and bottom spacers from pylon to tail. Now add three pylon formers. These will automatically take up their proper angle against their respective diagonal spacers, but you can check to ensure that they are inclined at 70 degrees to the horizontal. Cut and fit pylon head, using pattern on plan, which will further insure accuracy of pylon line-up and wing angle of attack.

Add remaining spacers, also firewall (with engine mounting bolts inserted and locked in position where appropriate) and landing gear box. Construction of latter is shown on plan. Note that it extends full width of fuselage and should, therefore, overlap longerons by 1/16". If you are using a beam mount engine, also fit hardwood motor mounts at this stage, adding a 1/8" hard former behind landing gear box, in place of the 3/8" x 3/16" spacers. Make sure that all joints, especially hardwood surfaces, are well cemented around this area. The engine mounts (both beam and radial type) and landing gear, it will be noted, are very securely tied to one another and to fuselage by interlocking one with other. When covered with 1/16" sheet, nose end is practically crash proof.

Complete pylon by installing front and rear uprights, after tapering them to required section, and fit wing dowels. Cover both sides of pylon simultaneously with medium-soft 1/16" sheet, starting from bottom and working up. Grain should run horizontally. Score on inside, or steam strips if any difficulty is experienced in getting them to follow curve at leading edge. Carefully pare down top edges to the head contour and reinforce edge with a strip of 1/16" sq. cemented around inside. Then add 1/16" sheet wing platform, with grain running laterally, and also two plywood supports at leading and trailing edges. Fuselage is covered with 1/16" medium-soft sheet and the whole sanded down to an even thickness of about 1/20".

The wing uses MVA .301 section, which we have employed in a number of contest gassies, as well as big gliders, over the past three years. This section is now gaining wider recognition and was used (modified slightly to give more undercamber) by Gunic's winning model at the recent World Model Glider Championships held in Austria.

The wing tapers out to a flat undersurface at tips and a small washout angle is also built in. The rear spar is tapered down to 1/8" x 3/16" where it joins trailing edge. If you are using one of the lighter motors and can afford a little extra weight in front of C. G., it is well worthwhile to web front spar by fitting pieces of 1/16" sheet between ribs, cemented to rear faces of 1/8" sq. top and bottom spars. The spars have been carefully located to give strength and to avoid excessively sharp changes in contours of covering.

Do not neglect to key wing to pylon. Our method of doing this is to insert short lengths of 1/8" diameter dowel in leading and trailing edges so that about 1/8" is left protruding, which is domed off. These pegs fit into holes drilled in plywood supports. Should it become

(Continued on page 38)

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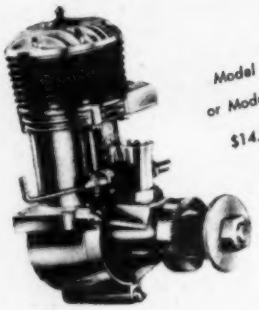

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necessary to realign the wing, one of the ply supports can be cut loose, moved fractionally sideways and re-cemented.

The stabilizer construction is similar to that of wing. Trailing edge is swept forward to triangulate that part of the stab most prone to warping. Allied to a sheet covered leading-edge, this gives a stab structure which is more warp resistant than most. Note that stab, too, is keyed on in this instance by means of short lengths of 1/16" sq. hard balsa cemented onto leading and trailing edges either side of stab platform.

Usual type dethermalizer hooks are fitted to rear end of fuselage and trailing-edge of stab. The front hooks consist of long wire prongs over which rubber bands are looped, close to leading edge, and passing around fuselage. When trailing edge is released to dethermalize, these rubberbands pull down on the prongs and, as stab tips up, slide down into the hooks, holding stab firmly for an even keel descent. Strong thread shrouds limit stab angle to 40-45 degrees.

A wire skid, attached to sub-rudder is used in order to keep tip fins or rudders clear of the ground and thus reduce risk of upsetting stabilizer alignment during take-off. This is particularly desirable where a tipped tail trim is used.

The complete model, fuselage included, is covered with *Silkspan*, or its English equivalent *Modelspan*—light grade in both cases, not heavy gas model quality, which takes up too much dope for a model of this size. Needless to say, wing and stab should be pinned down while dope dries to prevent warping but remember washout on wingtips.

To get optimum performance from the model, try to find the prop best suited to it and to the motor you are using. There is a general tendency, it seems, to use props of too small a diameter and often with too much pitch or with wide blades and blunt tips which waste power.

Modern model motors, admittedly, must not be loaded with big diameter props which hold down revs and prevent them from developing a reasonable proportion of their maximum potential output, but if you use a small prop simply so that engine can approach its peak power, chances are that you are getting no more thrust than you would with a bigger prop running much slower; if you want the best performance, therefore, you must aim at a reasonable diameter and, at the same time, choose a prop design, or modify a stock size, so that power absorption is not too great and motor is allowed to turn at a reasonable speed.

This means that thick, wide-blade, coarse-pitch props with blunt tips are out. Generally, we standardize on a pitch of half the diameter, blades being of medium width, fairly thin, with tips well thinned down and rounded off. We can get as much as 9500 rpm with a 10 x 5 prop of this type on a good 2.5 cc diesel. In general, it does not pay to reduce diameter of prop below 9" with any 2.5 cc diesel powered International class model, whatever pitch or blade form is tried. This does not necessarily apply to glow-plug types, all of which tend to require smaller props than diesels, but accent should, nevertheless, be on maintaining a reasonable diameter and keeping revs up by avoiding excessive pitch, blade.

A basic downthrust of two degrees is built in, but this can be adjusted to suit motor used. The method of trimming for turn is largely a matter of personal ideas, of course. Our usual method is to tip stabilizer mounting about five degrees or so that it is approximately parallel with inner dihedral angle. This will give a glide circle of about one complete circle every 20-25 seconds, which is just about right for visibility. Power flight can be straight with a model of this power loading or a slight turn to left or right can be used. Adjust thrust-line, giving compensating side-thrust, if power turn shows signs of being excessively tight.

END

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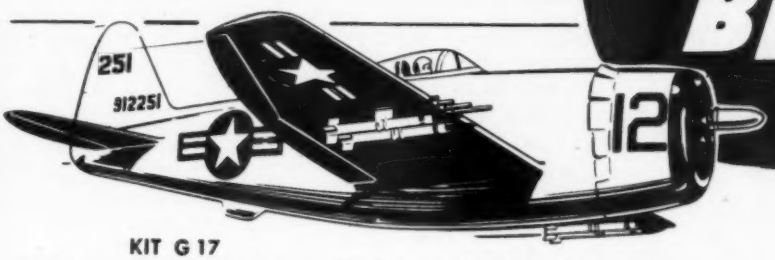

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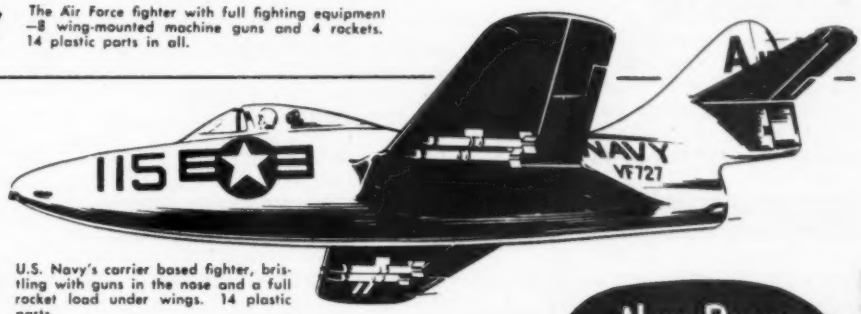

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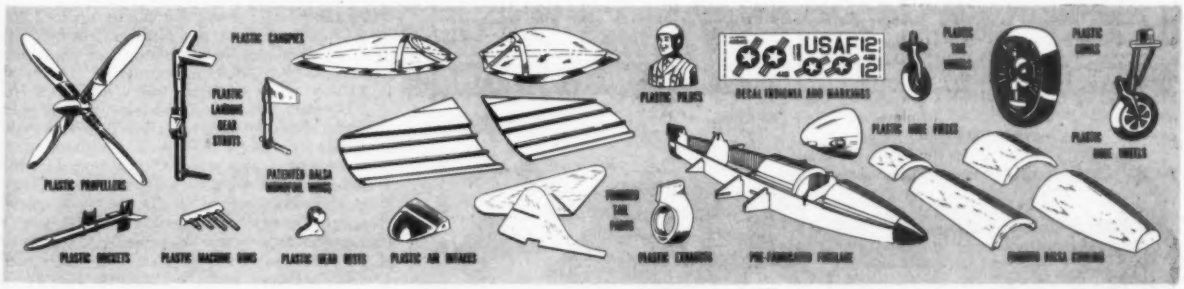

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Tiny Mite

(Continued from page 34)

slid off to shift the wing position.

If you have chosen to carve your own prop, here is the procedure: 1—Mark off divisions as indicated in the step-by-step sketch; 2—Taper to diagonal lines that cross at center. Cut away back of hub to half of original depth. Hub width should be 3/16"; 3—Carve underside of prop first. Either a flat surface or slight hollow on the back of the blades is Okay. Check as you go along to see that the same amount is hacked away from each blade, as you want the prop to balance reasonably well; 4—Turn over and carve front of blades. Note that taper starts a bit back of the leading edge to insure proper strength and airfoil section; 5—Round off tips (template may be made to assure exact similarity) and sand all corners to attain a streamlined or, preferably, an airfoil section along most of the blade. Stick a pin through the center of the prop and check the balance. Several coats of cement at the light tip or a short bit of pin stuck in if it is "way off" on balance. Insert prop shaft, bend front end and cement.

If necessary, open up the "hook" end of the prop shaft to insert it through the thrust bearing, then bend it back to original shape. Three washers, with a tiny drop of light oil should allow the prop to spin freely when two loops of 1/8" flat rubber are in place. A test glide with 20-30 turns in the motor should show if the balance is right. If the model dives too steeply, move the wing forward; if it hangs on its prop and stalls, shift the wing back a bit. Increase the number of turns on successive flights until you are packing in about 140 turns. That should really get *Tiny Mite* a-scampering into the blue yonder.

European Trends

(Continued from page 13)

more powerful than the Nordec, it was, however, built for model racing car work.

The highest speeds claimed by models powered by Euorpean motors to date are 149 mph, put up at the 1952 Belgian/British challenge contest at Namur, Belgium, by R. Gibbs of Great Britain, using a McCoy-based Checksfield custom-built motor, and 147.8 mph at Schiphol Airport, Amsterdam, by A. Hagedoorn of Holland, using a Super-Typhoon engine.

In Class II (5cc or .30 cu. in.) the engine situation is a little easier. Nearest to equalling Dooling 29 performance is the British Eta 29 Series III, which will deliver about .65 horsepower at 16,000 rpm, and a number of others of the usual disk-valve type claiming over 1/2 hp, including the French Micron 29 and the Dutch Typhoon-IV, are available.

There is no F. A. I. .19 cu. in. class, of course, Class I being for motors up to 2.5 cc (.15 cu. in.) a popular displacement motor in Europe. At the Namur contest last year, Peter Wright of Gt. Britain achieved 165.136 kmph (102.5 mph) to better the World record of 97.4 mph held by Czechoslovakia. Wright, (who holds the current British 5 cc class speed record of 124.54 mph with his Dooling 29 *Bazooka* has also achieved 105 mph with this same E. D. 2.46 powered job. F.A.I. Class I is the one category which we had expected would be held by Europe for some time. It came as some surprise, therefore, to hear of an American claim of 111.8 mph in this class (Mark Brown again with a .147 version of the K & B .19) and this has really given Europeans something to shoot at.

In general, European speed models follow the standard layout made popular in the U. S. usually featuring a high mid-wing layout, upright helmet-cowled motor and no rudder. More and more models, however, are now using a lower cowl with the cylinder head exposed. Wing areas are similar to current

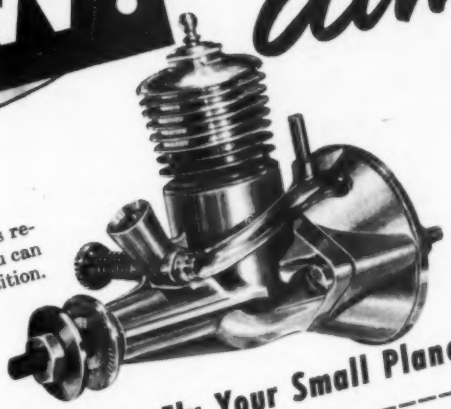
(Continued on page 42)

1953's Model NEWS Sensations

① This NEW!

CLASS "A"

Atwood .051



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U. S. trends, perhaps tending to be slightly bigger. Straight-taper wing and tail surfaces are usual practice.

Construction varies considerably. As in the U.S., all-balsa structures are not greatly favored and hardwoods of various types are more common for fuselage shells. Formed aluminum wings are becoming more popular, while stabilizers are invariably of aircraft-plywood or light metal. Cast light-alloy bottom shells are not often seen, although one or two leading fliers have employed them. Drop-out two-wheel Sadler-pattern landing-gears are used by a number of modelers, others using three-wheel or four-wheel dollies.

Early British stunt jobs were generally powered by big American motors, the Super-Cyke and Ohlsson 60 being two of the most popular. Models were around 400 sq. in. area, light in weight and ugly in appearance. A little later, a smaller type stunter, equally ugly, often of the profile fuselage type and suitable for .12-.15 cu. in. diesels then available, started to appear. It was one of these which won the first official stunt contest at the British Nationals in 1948. Then, between this and the next years contest, there were some big developments and some hot, lightweight engines, admirably suited to stunt, started to appear. These included the .15 Elfin, .21 Amco and the glowplug .30 Yulon.

With the availability of these engines, plus, at the end of 1949, the Frog 500, (which is similar to the earlier K & B Torpedo) standards of stunt flying improved tremendously and the trend of model design was more towards ships of around 300 sq. in. and 18-20 oz. weight, using .20-.30 cu. in. motors. Barn-door shapes, too, began to give place to more graceful semi-scale proportions. Corresponding to Harold deBolt's *Stuntwagon* design, came the Mercury-Monitor, a kit job which, although a low wing, used a similar layout, i. e. sleek, streamlined design with no landing-gear, big wing area, short tail-moment, no offsets, no line-rake and depending mainly on its speed and an outer wing weight to maintain line-tension.

The Monitor represented something of an extreme in stunt design at this time but was very successful in contests, despite the fact that it would tend to "slide down the lines" if the motor cut overhead. Other designers adopted "safer" layouts, using offsets and/or raked lead-outs to realize better control in emergencies. Brian Hewitt, who had convincingly won the 1949 Nationals event with a Yulon powered "barn-door" model using just about every known safety device, compromised by employing offsets on a semi-scale mid-wing Yulon-powered model for 1950, and won again.

The writer's design of the same time, *Yulupa*, also Yulon powered, combined what was thought to be the best of both schools. Of scalish appearance, it had a moderately short tail-moment, 40" span, 270 sq. in. wing, no engine offset but a five-degree rudder offset and two-degree line rake. The 25% c.g. and 40% pivot-point were selected for the best balance of maneuverability and stability; the model would fly around virtually "cutting a groove" a foot or so off the deck with no effort from the pilot, yet would whip through any maneuver, tight and smooth, following its nose all the time, with no tendency to "much".

This could also be partly attributed to its lightweight (20 1/2 oz.) and to the motor, which would put out about 13,000 rpm in the air on a 9 x 5 prop and never miss a beat through the tightest maneuvers.

This ship flew at 70 mph on 60' lines which did not make it eminently suitable for dreamy pilots. There is also the objection that the quality of the maneuvers of a fast model are difficult for the judges to determine, and stunters powered by a 30 cu. in. motors are now giving place to smaller ships again and the .15 cu. in. diesel is the motor more commonly

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used. Even so, many of these small jobs are still very fast. So far, in Britain, there is no evidence of the tendency towards heavier and larger models for a given motor displacement that has been the trend in America, although one or two recent Continental designs suggest that others are giving it a tentative try-out.

Alan Hewitt, who, following in his brother's footsteps, won the 1951 and 1952 British Nationals stunt event and also won the '51 F.A.I. World Stunt Championship and '52 Belgian Challenge meet stunt event, uses a small, 240 sq. in. Elfin 2.49 (.15 cu. in.) diesel powered job which weighs less than 12 oz. It is very fast (about 70 mph on 50' lines) and he originally built it for the sake of convenience, his .30 cu. in. job being rather too big for the small circle at the Belgian contest site. Obviously, a small, fast-flying model is not the best type to choose for impressing the judges and, although it speaks volumes for Hewitt's piloting skill, it is also illustrative of the fact that he has little to worry about in the form of really intense International opposition. Hewitt did not attend the 1952 international stunt championship contest, his place being taken by Peter Ridgway, another top British stunt pilot, also flying a small diesel-powered job. He, too, carried home the hardware for Britain.

In general, European stunt models tend to be less heavily loaded than their American counterparts. Flaps are not so widely known as in the U. S. and, although design is now definitely established along semi-scale lines, attempts at realism are less elaborate than is apparent in the latest fashions from the U.S.A.

U-control, and stunt flying in particular, reached the peak of its popularity in Britain in 1949/50. Since that time there has been a renewed increase in free flight activity so that the number of control line enthusiasts is now proportionately less.

The decline of stunt, however, has been partly countered by the introduction of team-racing to Britain. The first organized team-race took place in March 1950 and, since then, much progress has been made. There are now two classes. Class B, the original category, for motors up to 5 cc and based on the F.A.S.T. rules, has since been supplemented by a Class A category for models powered by motors up to 2.5 cc. Class B calls for a 30 cc (1.83 cu. in.) maximum tank capacity and 125 sq. in. minimum wing area. Class A allows a 15 cc tank and 70 sq. in.

The F.A.I. have not yet interested themselves very much in team racing and, actually, team racing does not seem to have attracted a great deal of attention outside the English-speaking world. Therefore, Britain apart, we do not have very much to report on team racing from Europe.

It has to be admitted that, in appearance and realism, European team racers have so far failed to achieve the standards so admirably maintained by the F.A.S.T. group, but performances have steadily risen and, in Britain in particular, some very fast models and rapid pit work have been seen. In Class B, 90-100 mph speeds are now being realized, using Dooling and Eta 29 motors, with over 40 laps on 52' 6" lines, i. e. calling for three refueling stops in a ten-mile race of 160 laps. Class A models achieve around the 70 mark and are flown on 42' lines.

Due to the lesser accent on true scale proportions and consequent simpler construction, Class B models tend to be somewhat lighter than the U. S. equivalent. Fuselages are generally planked or of sheet balsa construction, but wings are sometimes paper covered. The result of this has been that some models have weighed a mere 16 oz., but there now seems to be a trend away from excessively light construction due, no doubt, to the relative frailty of such devices and consequent inability to stand up to the rigors of actual race conditions.

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NOBLER: Aldrich's Plymouth stunt job. June '52.

FUNSTER: Kading's Nats free flight. June '52.

[illegible]NG: Free flight sport wing for AA. May '52.

[illegible]ENGER: Shulman's diesel team racer. May 52.

HOTTER 'N THAT: Fox-powered stunter. April '52.

SUPER SAUCER: Soaring towline glider. April '52.

BEAVER: Control line model for .19-29's. Feb. '52.

ZENITH: Taibi Class A '51 Nats cabin job. Feb. '52.

HALF WILD GOOSE: Half A free flight. Dec. '51.

FIRECRACKER: Flying scale u-control. Dec. '51.

In 1950, some of the team-race enthusiasts who set the ball rolling, elected to use diesel motors. Their idea was to utilize a smaller, more economical and easy-starting engine that would run through a race with, perhaps, only one refuelling stop, albeit at a leisurely gait, in the expectation that, while they were steadily circulating, the other competitors would be having ground crew trouble. And they were right. For example, the most successful racer of 1950 had an E. D. 3.46 motor. It could manage all of 55 mph flat out (according to our timing), yet it won race after race simply because, in those early days, minutes were wasted on the ground and, during those minutes, the slow E. D. job was reeling off its laps —sometimes 100 of them without stopping.

Over the last two years, however, handling technique has developed a pace and the fast jobs can be refuelled and sent off again in a matter of seconds, so that even a non-stop model would have little to gain unless it approached the speed of the racing-engined jobs. This, no doubt, corresponds to the present situation in America.

Turning now to a very brief review of radio control, we should first mention that, for some years, British enthusiasts enjoyed a considerable advantage over their American cousins in that license-free rc has been permitted here since 1946.

Commercial rc equipment became available shortly afterwards, although, until the advent three years ago of the gas tube (since regarded as something of a mixed blessing), there was little sign that rc would achieve any marked popularity. Now, although there are still people who give up immediately on discovering that this branch of the hobby is anything but all-play-and-no-work, there is a steadily growing interest in rc.

For the most part, we are still in the rudder only stage and the more that one sees of rc, the more one realizes that it is in the simple rudder-only model that its future popularity depends. There is, undoubtedly, a good deal yet to be learned even about rc model design and trimming and flying before any widespread switch to more comprehensive control systems is made. This applies particularly to the aerobatic model depending solely on rudder control.

For the more advanced enthusiast there is now adequate and reliable radio equipment in the shape of reed units for multi-channel control, via multi-tube receivers. The "popular" line of rc gear, however, is concentrated mainly on the single tube set, with a trend away from gas tubes to hard tube circuits.

Model design has followed much the same trend as in the U. S. A. Early jobs, using the heavier equipment then available, were fairly large and resembled the typical pre-war type cabin gas jobs, two popular kit jobs being the Keil *Falcon*, a pre-war eight-footer comparable with Bill Effinger's *Super Buccaneer* and Col. Taplin's *Radio Queen*. Other popular designs have been (and, in fact, still are) Dr. Walter Good's *Rudderbug* and the five foot Keil *Junior 60*. The most popular size now is something between 50 and 70" span and weighing 2-31/2 lb. Diesel motors of between 1.5 and 3.5 cc are the usual power unit. Design generally follows the standard cabin layout but aerodynamic layout varies somewhat. Most modelers seem to use too much wing incidence, needing a lot of downthrust to hold the nose down to penetrate the inevitable wind. Our personal preference is for zero incidence, no downthrust, with longitudinal trimming by means of the c. g. and a lifting tail. More power, we find, can be used in this way.

In Continental Europe, rc has not been given the same attention commercially as it has in America and Britain, although imported equipment is available. It is, no doubt, only a matter of time before a widely attended F.A.I. sponsored International rc meet becomes a regular annual feature as in the case of free flight and control line. END

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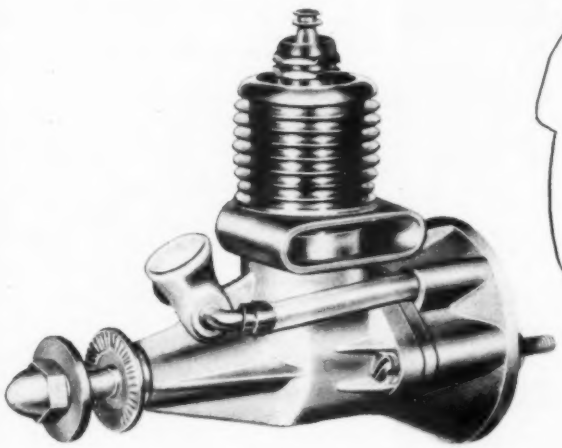

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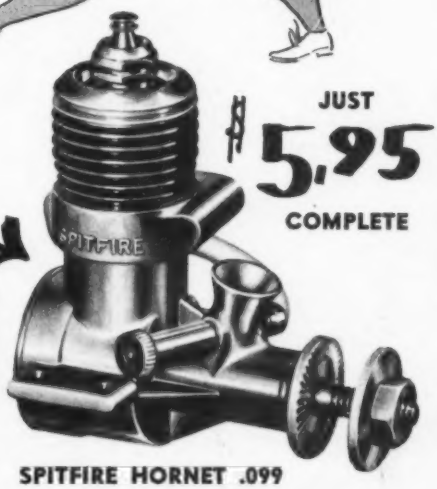

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Acrobat

(Continued from page 31)

Inverted flight was accomplished by heading into the wind, then performing a 1-1/2 turn spiral, allowing the ship to pull out, top to the wind. During the pull out up elevator was used briefly then, approaching the top of the loop, down was applied and held. This produced a nose high inverted position maintained for at least six seconds, after which the nose dropped. Beautiful Immelmans can be performed by applying rudder at the top of a loop following up elevator. The key to safe operation is to immediately fall back on rudder flying if things get too hot to handle.

The *Acrobat* is a sturdy plane. During its development it once dived in from 75 feet, (broken prop!) has cartwheeled several times at high speed.

Do not increase either the flipper movement or area for ordinary flying as the amount shown produces a vertical dive almost as soon as you think about it. Inverted flight was performed with flippers 3/16" wider than those shown, but that amount of area will tuck the ship under in a dive within 50 to 75 feet.

When trimming the stabilizer be careful to note whether or not the movement alters the flipper position in neutral. On the original ship, the stab was held on with rubber. For rudder only flying this is okay, but it was found that when flippers are employed it is desirable to affix the stab permanently in place. Sturdy keys were knocked loose in flight, giving changes in flipper angles which made the plane difficult to control. It is suggested that the stab be lightly cemented in place during test with rudder only, then be heavily cemented in place before use of flippers. The best way to trim for windy flying is to add solder to the nose, not to alter angles of the flying surfaces which always reduces stability.

Engine Review

(Continued from page 22)

This porting system of two opposed exhausts and two opposed bypass ports, between one another and on the same plane, was dropped by most manufacturers some three years ago as being volumetrically and aerodynamically inferior to the 360° radial design. It is therefore intriguing to see a new engine setting a new high in performance from the old system. The only obvious explanation seems to be that most radial systems are inclined to atomise the fuel quite thoroughly as the mixture blows out of the bypass ports; whereas the old system is not so good in this respect, it is quite likely that it is even better at the real business of admitting and releasing gases and, since our spraybar carburetors are poor atomisers, we have never before seen it work to advantage.

With the leaf type admission valve employed in the *Space Bug*, however, the fuel practically vaporized as it passes the sharp edges of the leaf, and the mixture arrives as a highly combustible gas at the hot bypass ports, thus giving the porting system a very great advantage. This is borne out by the fact that the *Space Bug* is a clean running engine producing virtually no smoke. Efficient combustion is achieved.

The piston design is ingenious and original. Machined from bar, hardened, ground and honed, the walls gradually increase in thickness towards the point of maximum stress at the crown which has the usual conical form. The ball joint features a method of retention which allows no play and slop. This is achieved by seating the ball in a spherically recessed boss inside the piston, and retaining it with a formed aluminum cup which is slotted to allow sideways entry of the rod shank. This cup has sufficient spring to allow a snap ring to be located in the groove in the piston skirt, without leaving the slight play necessary to assembly of most other types of ball joint. The rod has absolute freedom of oscillation and is excellently lubricated by oil entering through

(Continued on page 48)

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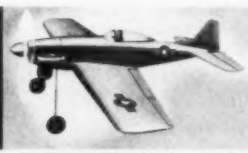

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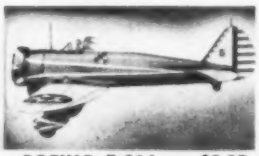

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the slot in the cup and thence flowing down and around the inside. Another important advantage of this arrangement is the relatively large area of well lubricated bearing surface provided, which will give exceptionally long life.

An unusual feature of the *Space Bug* pistons and cylinders is that they are all produced to the same dimensions. This means production limits of one forty thousands of an inch, which is engineering at its very finest, and, until recently, considered by many authorities to be economically impossible, owing to the high scrap potential. Usually, selective assembly methods are employed which means that every piston and cylinder forms a matched set, replacement of one requiring replacement of both for maximum power. In the *Space Bug* you can replace either component individually and yet maintain the same efficiency.

The conrod is machined from aluminum, the ball end having almost perfect sphericity, and the crankpin bearing displaying outstanding finish with no reaming marks, with the unusual luxury of machined and chambered faces on both sides. The fit on the crankpin is just right, in view of the high surface finish of both components. The general design and dimensions of this rod are such that it will comfortably survive the most severe abuse.

The crankshaft design shows recognition and treatment of two problems which have been, hitherto, largely ignored in small engines as being too insignificant for serious consideration. However, with engines that turn 17,000 rpm. and upwards, some attempt at balancing is bound to show a slight benefit, and the damaging effects of vibration on featherweight models, particularly with tank-mounted engines, justify some corrective measure. With comparatively low speed small engines it is unlikely that a counter-weighted shaft would make any difference, but with the high performance of the *Space Bug*, together with the overhung tank mounting, this type of crankshaft pays off to a surprising degree. The counterweight on the *Space Bug* is arranged to balance all the rotating weight in the engine, but ignores the reciprocating weight of the piston assembly, which is impossible to completely balance in a single cylinder engine and, while not the theoretical ideal, has been found to give the best results in practice on model racing engines. One explanation of this phenomenon is that the resulting high gyroscopic stability resists and damps out the high frequency oscillations set up by the rapidly reversing piston. As a result, the *Space Bug* is exceptionally smooth and free from vibrations.

The other question has been frequently raised in previous tests, namely, the vital effect of the crankshaft bearing upon engine performance, and the importance of reducing surface friction to the absolute minimum. The *Space Bug* has polished shaft and crankcase bearings, but in the absence of the usual shaft rotary valve, is able to incorporate additional improvement. If you will visualize the loads on a crankshaft, the piston is trying to push the shaft through the bottom of the crankcase. It is prevented by the shaft bearing which is, of necessity, not in direct line with the pressure from the piston, and therefore gives rise to a couple which tends to tilt the shaft. Since there has to be a small amount of bearing clearance for free running, the shaft actually does tilt a minute amount, so that it is only resting on two points in its bearing; on the bottom at the back end and on the top at the front. The inevitable result is that a shaft bearing always wears egg shaped and tapered. It therefore becomes evident that the center portion of the shaft does no work as a bearing, and since it also causes viscosity drag on the surrounding oil, would be better out of the way, and thus allow oil to flow more freely to the heavily loaded portion at the front. The *Space Bug* achieves this aim by reducing the shaft diameter in the center and leaving 3/16" length of bearing

surface at each end. It will be found in practice that this small surface will give less friction and longer running life than a normal full bearing shaft. The *Space Bug* is one of the smallest production engines featuring a phosphor bronze crankshaft bushing.

The crankcase is pressure diecast in aluminum alloy with the bushing cast in position. The volume of the crankcase is very small for this displacement and therefore achieves a very high charging efficiency. A large circular chamber is cast on the back of the crankcase on a slightly lower center line. This chamber accommodates the reed valve assembly which is mounted on the front of the fuel tank. Four bolts passing through lugs in the crankcase, screw into the face of the fuel tank to secure the two units, with a paper gasket sealing the joint. These bolts are equally spaced so that the tank may be located in any of four positions. Since the tank has one up, one down, stunt vents, and the carburetor is cast into the tank with the needle valve projecting from the side, this arrangement offers four different engine mounting positions, i.e. upright, inverted, and either side, with the vents and needle control in the same position modelwise. By turning the tank upside down, you have the same choice of mounting, but with the vents set up for U-control in the opposite direction. An important advantage is that the needle control is situated well away from the prop.

The most distinctive feature of the *Space Bug* is its reed admission valve and a great deal of patient experiment must have gone into its development. The concept of the reed or flap valve is considerably older than gasoline engines, and is by no means new to the two-cycle engine, as it has been applied in principle on many full size designs, notably on outboard motors. However, it has often suffered from an inability to work efficiently at very high speeds owing to inertia effect and the small magnitude of the force which operates it, namely, atmospheric pressure. The properties required of the reed are extreme lightness, springiness and resilience. It must flex easily and to a great degree, without losing its shape, and in order to achieve lightness and therefore low inertia, must be made from a metal that has these properties when rolled to less than tissue paper thickness. Steel has but little spring under this condition and would be difficult to temper accurately, but the tough and much more expensive beryllium copper has apparently been found satisfactory. This material has high fatigue resistance and provides a reliable and very efficient valve. It is particularly important, however, not to leave raw fuel containing nitro in the engine when not in use, as it attacks this metal more rapidly than steel. Chemical action will reduce the working life of any unemployed nitro burning engine, unless it is run dry and flushed with castor oil prior to storage.

The operation of the reed valve is simple. When the engine sucks, the valve opens, and when the engine blows, the valve closes; which to be more specific, means that when the piston commences its upward stroke the area of low pressue in the crankcase is filled by mixture, motivated by atmospheric pressure pushing the reed valve open, and when the piston returns on the down stroke, the high pressure thus created in the crankcase pushes the valve closed. In the *Space Bug*, the reed is in two layers of the same material, one being extremely thin and able to conform exactly to the intake port seating, and the other somewhat thicker to provide springiness and protect the first. The degree of flutter is limited by a pressed steel backing plate in order to prevent valve damage from flexing beyond the elastic limit of the material, and to ensure that it does not open so far that it cannot close in time to conform with the operating cycle. These components are retained in position on the valve seating, which is also the front of the fuel tank, with a pressed on aluminum flanged ring. This ring is easily pried off for valve replacement, but should

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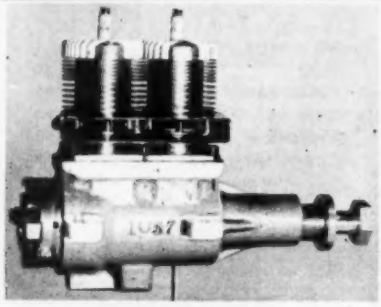

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not be removed unnecessarily as the interference fit will gradually be spoiled.

The advantages of this type of admission valve are several. The most important is that, whereas conventional types have predetermined and fixed opening and closing events which remain the same regardless of engine speed, they are therefore only efficient at one particular speed. The reed valve, on the other hand, opens and closes according to the demands of the engine, and, if correctly designed as in the *Space Bug*, is efficient at all operating speeds, so that the engine will have good torque and turn big props at low speeds, or wind up to 20,000 rpm on small props and give high power output at high speeds. It also means that although the *Space Bug* is a very fast engine, it will nevertheless, start and handle easily.

Correctly dimensioned for the particular engine, the reed valve will provide a larger valve opening and therefore enable higher volumetric efficiency, and consequently higher engine power output.

The large fuel tank incorporates in the same casting the entire carburetor unit and fuel system, with the induction pipe or air intake passing through the center of the tank and retaining the tank backplate in position with the aid of a screw-on air filter. This little filter is designed to prevent dirt from interfering with the reed valve seating, and will also retard the tendency for excess fuel to find its way from the intake into the fueslage of a model.

The prop nut is specially made to eliminate the need for a washer, and the tank casting includes the pick-up tube, thus eliminating the neoprene tube. The cylinder head is designed to use the conventional gloplug connector clip, and the needle valve is long enough to allow convenient operation when the engine is fully cowled. All machining, particularly of threads, is top quality both for finish and accuracy.

PERFORMANCE

When bench testing the *Space Bug*, it should be borne in mind that the pickup tube is located in the tank at center line level on one side to ensure efficient feed in flight, and consequently, under static running conditions, only half of the fuel capacity will be consumed. The remainder should therefore be drained after running, to avoid trouble from old congealed oil deposits. If the tank proves incoveniently large for power duration flying, the capacity can easily be reduced with filling pieces.

A feature of the reed valve is that the engine is enabled to run in either direction with equal efficiency, and the *Space Bug* has a tendency to start in the opposite direction to that intended, particularly on small props, no matter how hard you flip the prop. This is aggravated by partial flooding, and a certain amount of experience is required with the motor to know just how much to choke for a clean start in the right direction. Apart from this slight inconvenience, the *Space Bug* is a dream to start. Needle control is excellent, and once the correct setting is found for top speed, further manipulation is unnecessary for re-starting. A point to bear in mind is that the needle design is such that its precise operation depends mainly on the fit of its thread, and that unnecessary twiddling will cause rapid thread wear with erratic adjustment.

The racing combination now available for the *Space Bug* further improves the performance and, as the test figures show, is well worth the extra cost.

TEST

Thimbledrome Space Bug .049; Plug — Integral with head, 1-1/2 volts to start; Fuel—O & R.AA; Running time prior to test — 2 hours; Bore — .406"; Stroke — .386"; Weight—1.64 ounces.

Power Prop	*R.P.M. (Std.)*	*R.P.M. (Racing Carb)*	*R.P.M. (R. Carb & Head)*
6 x 5	11,500	11,500	12,000
6 x 4	13,000	13,050	13,500
6 x 3	15,200	15,400	16,000
5-1/4 x 5	13,900	14,000	14,550
5-1/4 x 4	15,850	16,600	17,200
5-1/4 x 3	18,500	19,300	20,000
Top Flite	*R.P.M. (Std.)*	*R.P.M. (Racing Carb)*	*R.P.M. (R. Carb & Head)*
6 x 5	11,000	11,000	11,550
6 x 4	12,400	12,400	12,900
6 x 3	14,000	14,150	14,700
Space Bug Plasticote (as supplied)	15,000	15,200	15,850

Flying Fish

(Continued from page 26)

ing between first two coats with #400. This will fuelproof your boat and retain its finish. Cut out celluloid .010 thick windshield and cement in place. If decals are used, brush on a coat of clear Testor dope to protect them from fuel and water. Be careful not to dissolve them.

Attach *Wasp* .049 engine and aluminum propeller with left hand pitch described in the first part of this text. Boat should balance where shown. Set rudder to run in circles or large arc that will run boat up on beach. Start your engine and place hull in water with nose pointed slightly up—then release. *Flying Fish* weighs only seven ounces complete so that it fairly flies after leaving your hand. END

Secrets of Free Flight

(Continued from page 20)

Sailplane that clocked 90 mph in level flight over a measured course, and my ships are considerably faster than this combination.

What should we expect a climb to be, or should I say, what determines the rate of climb? Well, the model, engine, and prop determine rate of climb. But how high can we climb a model? Let's examine some facts.

$$\text{Rate of climb} = \frac{33{,}000}{W} (\text{THPa} - \text{THPr})$$

W = Weight of model in pounds; THPa = Maximum thrust horsepower; THPr = Thrust horsepower required to fly model straight and level at a constant speed; THP = Engine power X propeller efficiency.

For example, here is how it looks on paper. Say your ship weighs two pounds and that you have an engine with 1/4 horsepower. If we knew the exact propeller efficiency it would be easy; however, I will assume that it is about 80% efficient.

So 1/4 h.p. x .80 = .20 (THPa)

Let's say that it requires 1/16 h.p. to fly your model straight and level; therefore, .0625 x .80 = .05 (THPr)

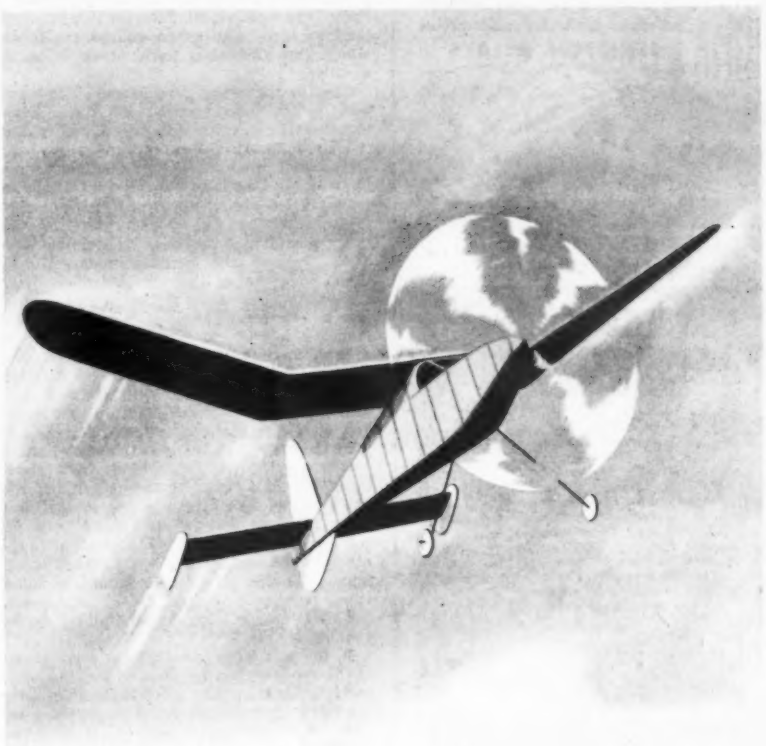
Substituting in the formula:

$$\text{Climb (feet per min.)} = \frac{33{,}000}{2} (.20 - .05);$$

Climb = 2475 feet in one min., or 825 feet in 20 sec.

How can climb performance be improved? By examining the formula we find that a lighter airplane will increase rate of climb; however, the rules on weight to displacement prevent very light airplanes. To examine the factors we can control, first, we can choose the best possible propeller which would result in an increase above the 80% I have used as an example. Second, we can use better fuels in our engine, use more powerful engines or "hop up" the engine we now use to increase horsepower as much as possible. Look at the formula for just a second. If we could increase the 1/4 h.p. to 1/3 h.p. this example would have worked out to be 1190 foot climb in 20 seconds. So you see it pays to use all the power you can get out of a given displacement. The third thing we can do is to reduce the factor of power required to fly model straight and level.

Let me point out that less the drag of the model, the less power required to pull it up to flying speed. By careful examination you can see that ships with stabs which provide part of the lift will fly at a slower speed than a model of similar weight with only the wing doing the work. If these deductions are correct, we then can obtain a higher climb from a model with large stabs, low angular difference, and CG placed so that stab supports part of the weight. Along these lines of thinking anything we can do to cut the drag of the model will result in an increase in rate of climb. It might be interesting to explore another fact. A straight climb results in a faster rate of climb than a spiral climb. Look again at the formula; the weight factor is involved here. A model flying straight has a less wing loading than when turning. If the model is spiraling up, the wing loading is greater than if straight; therefore, the "formula" thinks that the model is heavier, so the rate of climb is decreased. Let's make another compromise. A straight climb is the most efficient, but dangerous, and the pull out isn't quite as good as a spiral climb so I settle for one turn to the right in 20 seconds. The reason I stay away from a straight climb is, to obtain this setting, torque, gyroscopic forces, rudder, etc., must be balanced, and it's too easy to upset this critical balance. For example, when the ship is going up, if a gust of wind turns it in the direction of rudder, setting the rudder will become more effective and hold it in the turn. This condition isn't too good and can lead to dangerous spiral dives in the direction of rud-



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der setting, which in my case is to the left. I strongly recommend climbing the ship opposite the glide turn because then we have two forces which can counteract each other in gusty weather.

I realize that many good gas jobs climb and glide in the same direction, but I also know that this type of model has a high fatality rate.

During the testing period of the model I use a short dethermalizer setting because I am not interested in long flights at this time. The most practical type of dethermalizer for ships except ½-A is the parachute type. I chose this type because with "flap up" tail it is almost impossible to keep large stabs stationary during flight. When using a parachute dethermalizer, the attach point of the shroud at end of fuselage will determine angle of descent. For most models a low attack point will cause ship to dive with "chute" out and a high attack point will "mush" and cause it to become very unstable coming down. You will have to experiment with location of this point for your model as it is seldom that two different designs will react the same. As a point of reference I attach my "chute" shroud line about 1/2" above thrust line. I would like to suggest that you use a swivel like fishermen use in the main shroud line so that "chute" won't twist the lines when it comes out; also, cut a hole in the center of the "chute" so it won't "whip" when open. The size of the hole should be somewhere between 1/2" and 1-1/2" in diameter for a 17" square chute, depending on size of your model.

In the past I have read almost every article of this type that has appeared in the magazines and felt that something was left unsaid or some subjects were not covered completely. I can see now that it is not easy to write exactly what you think and by far isn't as easy as telling someone. I realize that I have only scratched the surface.

Skeeter

(Continued from page 14)

1/8" x 1/4" leading edge in place and sand round.

Cement wing tip blocks into place and, when dry, sand to correct shape. Be sure to cement about 1/4 ounce of lead into the right wing-tip; this will stop all chances of the model rolling in on the take-off or in gusty weather.

Cut out a control horn from .032 sheet aluminum and drill 1/16" holes in the ends and next to the pivot hole, which should be drilled to clear a 4-40 machine screw. Bend the pushrod from 1/16" piano wire and the lead-out wires from .016" piano wire. Assemble these onto the control horn and bolt to a piece of 1/16" plywood about one inch square. Slip the leadout wires through the ribs and wing tip from inside and cement the plywood holding the control horn, inside the wing, as indicated on the plan. When dry, check for free movement of control horn and lead-out wires.

Slip the pushrod through the slot and holes in the bulkheads and cement the wing into the notches in the fuselage sides. Bend a tail-skid from .030" piano wire and cement in place. Cut the tail assembly from 1/16" hard balsa and the elevator spar from spruce or pine. Construct a free-moving hinge between the stab and elevator spar and cement an elevator horn bent from brass or aluminum sheet, on the center of the elevator spar. Cement the stab onto the fuselage after slipping the pushrod into the hole in the elevator horn. Cement the vertical fin in place and, after shaping soft balsa blocks to fit on each side of the fin, cement in place. Check controls for free movement and make sure there are no tight spots that might cause trouble later.

Cut a piece of 1/8" plywood to fit at the bottom of bulkheads B and C and cement in place as shown. Cut the landing gear from .032" sheet aluminum and bolt to the ply-

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wood. Mount 1/2 oz. tank in the position shown with small blocks of wood. Install the filler lines in the tank to suit your own idea of easy filling.

Cement the 1/8" plywood bulkhead A in place and, while it is drying, cement the top sections of the other bulkheads in position. Plank the top of the fuselage with 1/16" x 1/4" strips of medium balsa, starting at the sides and working up. Allow these strips to overlap the bulkheads at the cockpit, so that you may trim them the correct shape. Cut the right side away forward of bulkhead A to allow mounting of the engine on its side. Notice that the engine is angled down six degrees from horizontal to allow the scale position of the cheek cowls.

Carve the cheek and bottom cowlings from balsa blocks and cement the left and bottom cowlings into place. Hollow out the right cowl to clear the engine and slot to allow for exhaust and cooling air passages. Cement cowl to fuselage and, when dry, cut removable section so that the engine can be removed and replaced when desired. Cement small dress snaps at top of fuselage and removable section so the section can be snapped on and off.

Carve a pilot or purchase one from your model dealer and cement in place. Then form a canopy from 1/16" plexiglass or from a standard model canopy and cement in place. Trim a standard spinner to the correct size or turn one from pine and use a machine screw of the same size as the engine crankshaft, through the center. Mount a pair of 1-1/4" wheels, preferably Banner type, on the landing gear with small machine screws.

For a good slick paint job that will be mistaken for plastic, use gray automotive primer for a base. Spray on about six coats, sanding with wet or dry paper after every coat. When you have a good smooth surface, spray on a good even coat of synthetic enamel and allow to dry. Mask off the trim and numbers and spray lightly until the white no longer is visible. If you prefer, the numbers can be made from trim film.

Balance the model at the front leadout wire, add weight in left cowl if necessary. If model is not steady in flight add more nose weight.

Amazer

(Continued from page 23)

into blade hubs, and bind with thread. Next bend blade stops of 1/32 wire, and bind to prop hubs with thread. Adjust stops so that air-loads on blades will not deflect blades forward of the plane of rotation. You will find that a little judicious bending with needle-nose pliers will remove any tendency of the prop to wobble, and small changes in blade pitch by bending hinges will yield control over power flow. Install a conventional shaft of 1/16 wire, mount assembly in the noseblock, provide a stop for the shaft, cover blades with Jap tissue, and prop assembly is complete. If you are unable to obtain soft, light wood for the blades, however, carve lightening holes in blades prior to covering. However, it is inadvisable to thin the blades in order to remove weight.

The fuselage is conventional in structure, and requires no explanation. The 1/16" sheet wing-rests are installed after entire top of fuselage is tissue covered, in order to preserve torsional rigidity. Note that the fuselage has no diagonals—they are not needed provided fuselage is well covered and doped (at least three coats, preferably four).

The wing employs "sliced" ribs. Make one rib template of plywood, metal or hard balsa and, using this template as a guide, slice upper ribs from 3/32" medium sheet balsa. Cut ribs 1/16" deep. Repeat this operation for lower ribs. Next, taper the 3/32 x 3/8" trailing edge stock from 3/8" wide at the root to 1/4" wide at the tip. Use a straight-edge for this operation, and remove wood from thick edge of stock, thereby reducing thickness of trailing edge toward tip. Taper spars to dimensions shown in drawing, then pin down leading and trailing edges. Next, fit lower ribs in place, flush with drawing, by trimming off excess length at trailing edge. Now, cement spars to lower ribs, then cement upper ribs to leading edge, both spars, and trailing edge. Make the false ribs (top only) using the forward portion of rib template as a guide. Assemble wing with 1-3/8" dihedral at each inboard break, and 3-3/4" at each tip. Add all gussets, butt plates and tips and wing is complete.

The horizontal tail is of the same type construction as the wing, except that lower ribs are 1/16" square stock. The upper and false ribs are of 1/16" sheet. The vertical tail is assembled on the fuselage. Note that leading edge of rudder extends through fuselage to form leading edge of sub-rudder. Note that leading edge is cemented to top and bottom left longerons, providing built-in right rudder. Mount stab platform on fuselage with shims so that when viewed from rear stabilizer is parallel to right-hand inboard wing panel, and the structure is complete. Sand all parts carefully, and add a second coat of cement at all vital joints, including rear motor peg supports and all dihedral joints. Cover ship with Jap tissue, applying two or three coats of dope to wing and tail, and three or four coats to prop and fuselage. Several extra coats of cement at hubs of prop blades will be added assurance of durability.

Make up a motor of 12 strands of 1/4 flat (or equivalent) 34" long, and lubricate well before installing in model. Use a short length of 3/16 aluminum tubing to hold motor at rear. A length of 1/8 wire may be slipped through the tubing to form a convenient method of holding the model while winding. Plastic tubing slipped over the prop shaft will adequately protect a motor of this size against cutting or bunching, but a bobbin may be

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used if desired.

Assemble model by pulling rubber bands over the wing, under fuselage, and back over the wing. The stab is held down by rubber bands wrapped around the fuselage and over wire peg in the stab. Note that when dethermalizer band is removed rudder serves as a stop.

The model should glide in a moderately tight right-hand turn. Make all incidence adjustments at the trailing edge of the stab. Under power, the ship should climb very steeply (about 45 degrees nose up) to the right. Once glide is satisfactory, make all under-power adjustments by varying side and downthrust.

Flying Scale

(Continued from page 17)

on its prop when the engine quit and the model took a long time and a lot of altitude to recover. If the motor run was short the model was into the ground before it recovered and settled down in the glide. It simply could not be trimmed for consistent good performance under full power.

A ½-A flying scale model on wheel gear should be underpowered to the extent that it will not climb unless under nearly full power. This will eliminate the violent aerobatics and poor power-on, power-off transition.

A later *Interstate* has been built to the same specifications, except than an Infant .020 is used for power. It performs very well, climbing smoothly and steadily under full power and there is no drastic change in flight attitude when the engine quits.

After seeing Bob Gilsdorf's beautiful *Swoose* (M.A.N. design 1946) fly, I felt that a ½-A scale model on floats could be practical and still use a more powerful engine than a comparable model on wheels. While the *Swoose* is not a replica of any full scale airplane, it shows just how highly powered and heavily loaded a scale type float model may be. The *Swoose* is powered by an .099 Cub, weighs 16-1/2 oz., and has a bare 140 sq. in. of wing area. It is very fast for a scale type model, clipping off an estimated 30-35 mph in level flight.

To watch this model fly is quite an experience. With engine leaned out and screaming it is not gently hand launched—it is heaved into the air. The climb is remarkably steady in wide left circles and, although the model is fast, it climbs at a shallow angle. When the engine cuts the *Swoose* settles into a fast, but flat right glide. When landing it comes in so hot it skips along the surface of the water for a good 100 feet before slowing down and settling back on the floats. As one observer put it, "Looks like a Fireball without lines."

The *Swoose* served as the inspiration for my Fairchild *24* (NC 87803) on EDO type floats. Wing area of the *24* is a shade under 200 sq. in., weight 10-3/4 oz., power a Royal Baby Spitfire .049. As a landplane it would probably fly, but with such a heavy wing and power loading by scale standards, the numerous small details and hand rubbed finish would be subject to damage.

On floats, however, this model is almost indestructible. A collision with a solid object is about the only thing that can damage it. Flying over water eliminates minor damage such as bent cowlings, cracked props, ripped covering, struts knocked loose, and wingtips scuffed from turning over or dragging a wing.

In flight the *24* is very stable, more like a good sport design than a scale model. The drag of the floats lowers the center of resistance far enough so that the model will not climb steeply or loop, even with the engine full out. The ounce and a half weight of the floats lowered the CG so that they have a pendulum effect on lateral stability. The model can be trimmed to bank steeply while climbing and still not roll over into a spiral dive attitude.

The EDO floats (6200 series) as used on the Fairchild, Aeronca Sedan, and Stinson Stationwagon are large enough when reduced to ½-A scale model proportions that they draw only 1/4" of water at the step. Takeoffs are therefore easily accomplished. The *24* rises on the step and actually planes off the water much like a real ship. Landings too are realistic with the model coming in rather fast but flat. It touches the water, bounces once, and then settles down on the floats.

Rubber power, while not as spectacular as gas nor as realistic, is often the only type of power that can be used in many scale designs and types. Because of its controllability it is a great help in trimming a touchy model.

An example of power tailored to the model is the Consolidated PT-11 Army Trainer. This little model is one of those "all one piece" types that is suitable only for rubber power. The wings and tail surfaces are very lightly built and cemented directly to the fuselage structure, rather than being the "plug in" or "pop off" type. It can readily be seen then that the added thrust of an engine would increase the flying speed to the point where a collision under power would completely wreck the fragile flying surfaces and attendant fuselage structure.

Another reason that an engine would be unsuitable for the *PT-11* is because of the weight distribution of the model. This model only weighs four ounces with rubber power and one ounce of this weight is distributed throughout the fuselage in the motor and prop assembly. An engine would weigh about the same, but with the weight concentrated in the nose of the model, it would require additional tail weight for correct flying balance. This would increase the wing loading and further increase the flying speed to the point where every flight would risk major damage.

The great advantage of using a rubber motor in a lightly built and rather fragile scale model is that rubber power is more easily controlled than a glow plug engine. This controllability is advantageous because the model can be tested by a series of power glides and gentle climbs until it is fully trimmed. The *PT-11* was tested by these gradual stages and the ship was never damaged during testing or subsequent flights due to uncontrollable power.

The main disadvantage of rubber power is that so much of the motor's weight is necessarily behind the CG. This requires light structure aft of the wing and practically rules out color doping of the flying surfaces. A heavily doped, short fuselage model like the Fairchild 24 would be a very poor flying model with rubber power.

When building and testing a flying scale model, there are several points to keep in mind. When selecting a scale model from a kit or magazine design keep it as simple in construction as possible. Follow the suggestions for setting and proportioning the flying surfaces to increase stability.

Use larger diameter and lower pitched props than would ordinarily be used for contest duration. These low pitched props allow the engine to turn up near maximum rpm without excessive torque forces. Tornado makes a series of 6/2, 7/2, and 8/2 props that are excellent for flying scale. Don't change the prop diameter or pitch when the model is flying satisfactorily. Prop changes can be distastrous to power-on stability.

When testing the model do so before it is color doped and detailed. Leave off the cowling and wing struts if possible. The model is more able to withstand the bumps and knocks of testing at this stage of construction and a lot easier to repair without tell-tale traces. After the ship is flying correctly mark the balance point and control surface positions. Now it may be completely detailed and finished. Rebalance and reset the control surfaces to their previous flying positions and the model will fly the same pattern as during testing although a bit faster due to added weight. END

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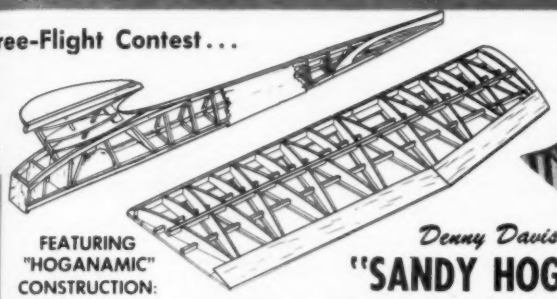

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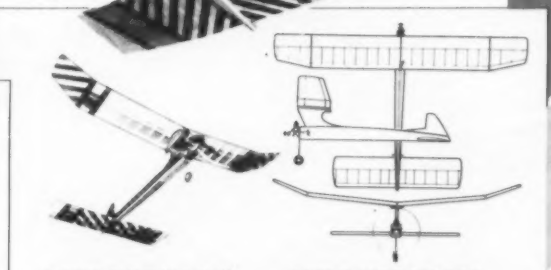

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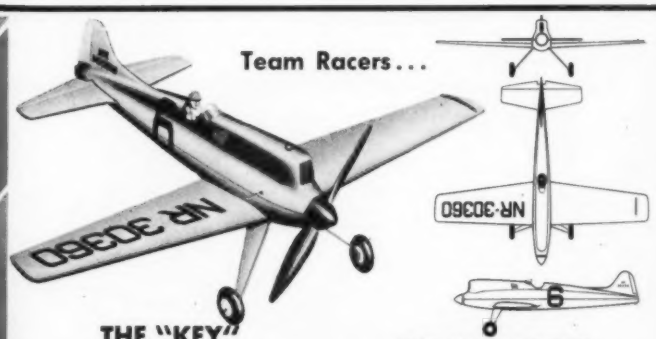

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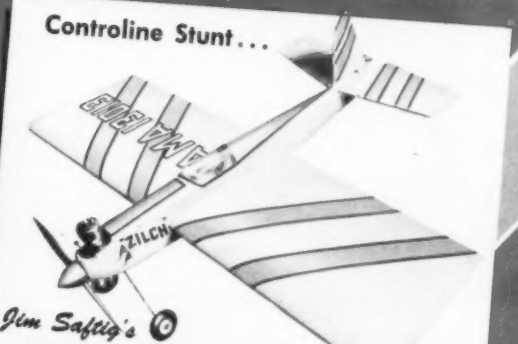

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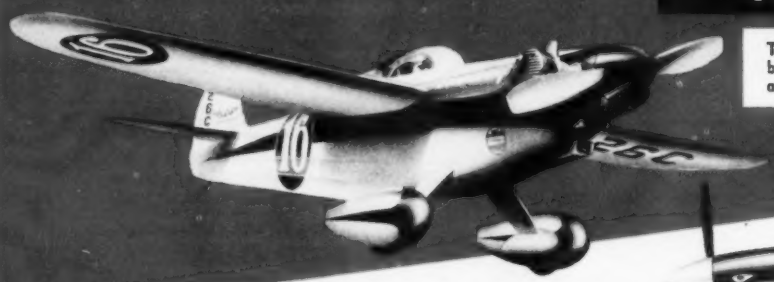

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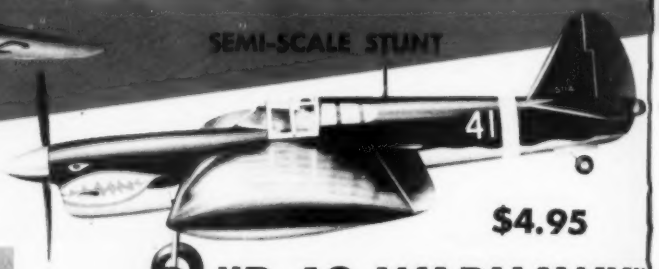

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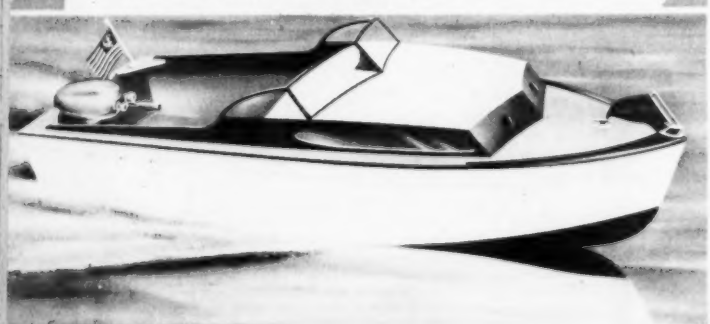

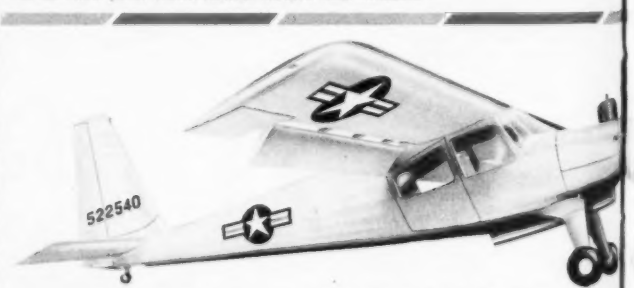

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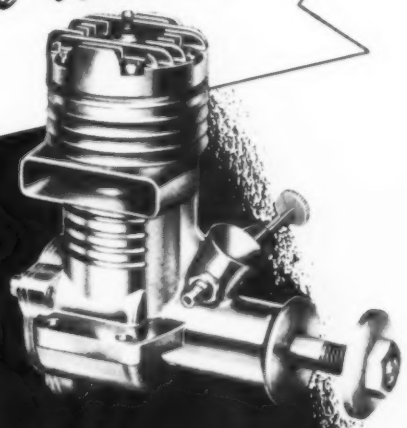

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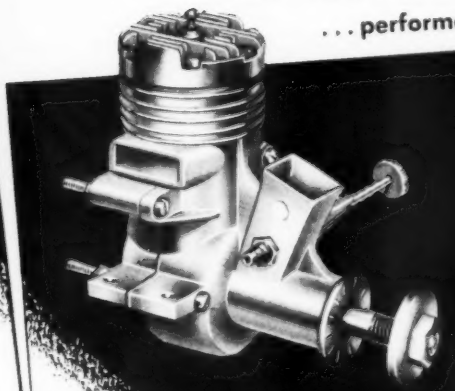

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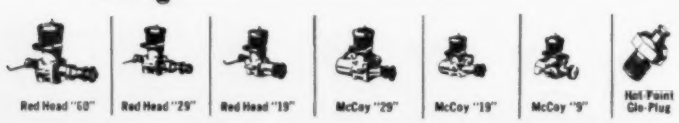

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